Mack Switch Point Protectors

Manufactured by THE FLEMING CO., Scranton, Pennsylvania

Economy. Prolong life of switch rails 6 to 8 times.

Safety. Shift wheel thrusts beyond point of switch rail.

One-man application—initial efficiency completely restored by reversing—low installation and annual cost. Manganese Steel Protector Plate.

One of America's Famous Trains

NEW YORK–FLORIDA SPECIAL

FLORIDA EAST COAST RAILWAY

WITH an average sustained speed of 49.3 miles per hour, the NEW YORK–FLORIDA SPECIAL rushes south over its 1,368 miles of track in 27 hours, 45 minutes. Last winter this train left New York at 2:05 P. M., arrived the following afternoon at 4:07 P. M. in West Palm Beach, and at 5:50 P. M. in Miami. All-steel Pullman equipment includes a full length recreation car for bridge games and other diversions, in charge of a hostess. A three-piece string orchestra is carried regularly. From January 2, 1936 to April 16, 1936, this train carried 30,341 southbound passengers. On 44 days of this period it operated in two sections; on 23 days in three sections; on 12 days in four sections; on 2 days in five sections and on 4 days in six sections. Since 1888 this train has sustained its reputation for luxury travel as the extra sections indicate. For such uninterrupted service, HY-CROME *Spring Washers* help provide the maximum protection to comfort and safety at least cost.

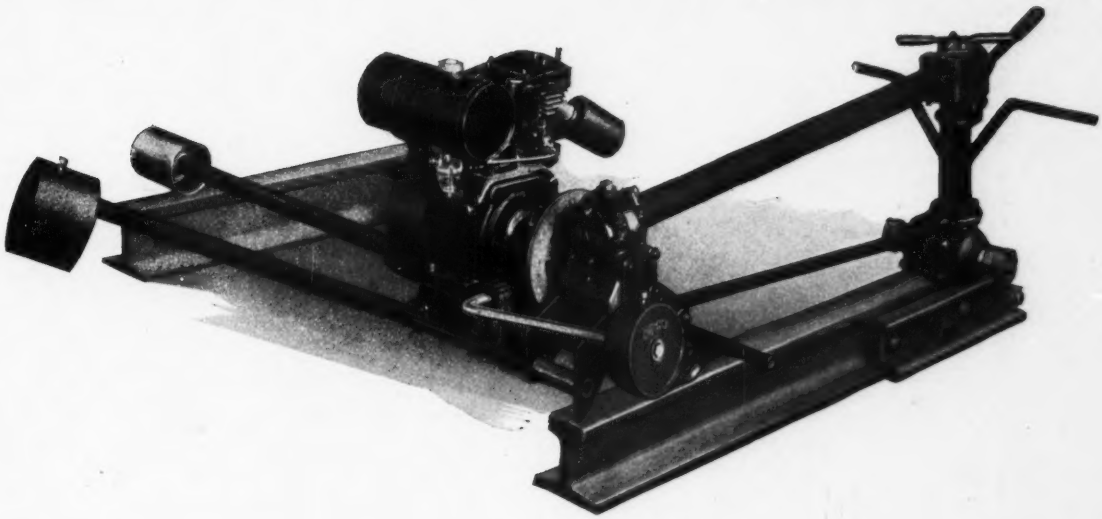
Reliance HY-CROME *Spring Washers*

A · REActive Deflected	THACKERAY	HY-REACTION	STANDARD	HEAVY DUTY	DOUBLE	BOND
Meets A. R. E. A. Spec.	*For screw spike use*	*For track bolts*	*For general use*	*For frogs—crossings*	*For special use*	*Used as re*

EATON MANUFACTURING CO. RELIANCE SPRING WASHER DIVISION, MASSILLON, O

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

Raco Power Track Machine



On 35 **railroads** throughout the country **over 200** Raco Power Track Machines have established remarkable service records.

Its counterbalanced operating head, self-centering chucks, convenient and easy controls and the fact that it pushes or pulls along level rail with a pressure of **only ten pounds, insure one-man operation and make for maximum speed with minimum fatigue of operator.**

Since it weighs **only 350 pounds** it can be readily removed from the track by **two men.**

Automobile type construction and the employment of modern Chrome, Vanadium and Molybdenum alloy steels **insure against excessive breakdowns and service interruptions.**

Bolt tension is controlled within exact limits by the Raco Dynamometer and Slip Clutch. **Any tension from 1,000 pounds to 42,000 pounds is instantly available.**

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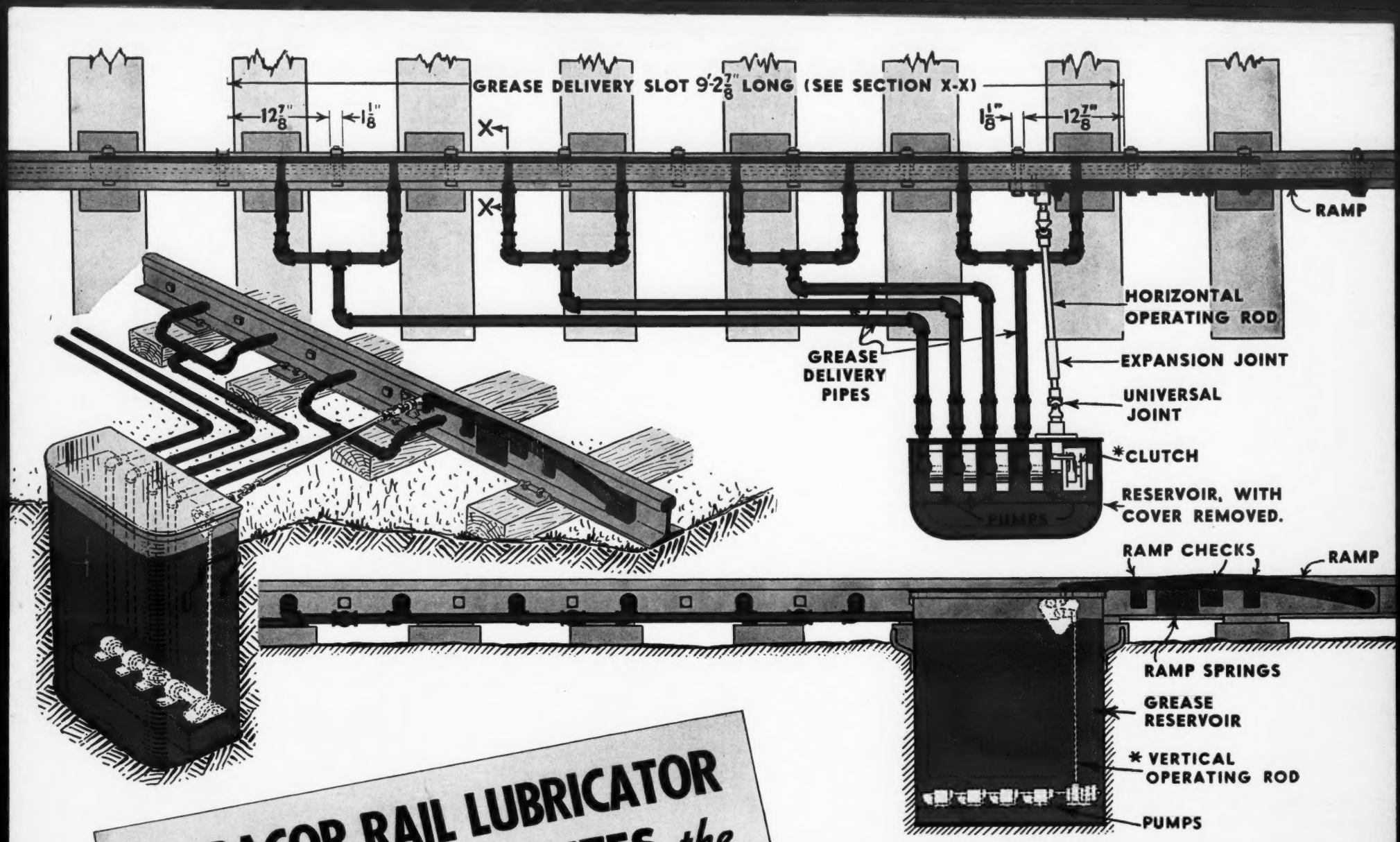
(Chrysler Building)

NEW YORK

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.



The RACOR RAIL LUBRICATOR DISTRIBUTES the GREASE

* NOTE — VERTICAL OPERATING ROD OPERATES GEAR PUMPS ON SPRING ACTUATED LIFT MOTION ONLY.

ON SPRING ACTUATED LIFT MOTION ONLY.

Right AMOUNT *of* GREASE IN THE RIGHT PLACE

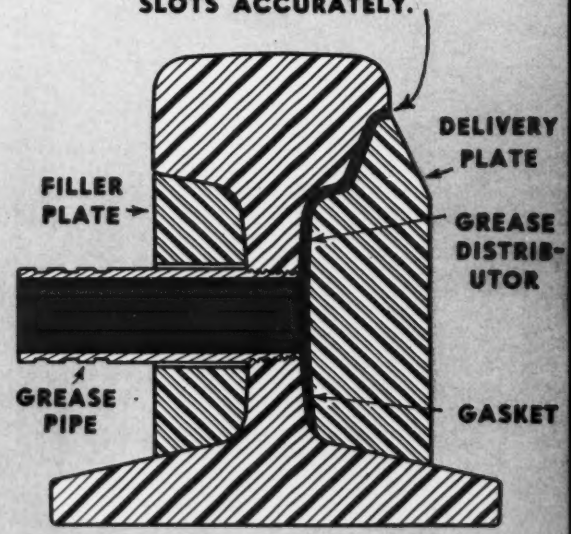
Extensive tests over a period of years have demonstrated that the Racor Rail Lubricator will apply more square inches of grease to the side of the rail head on curves and waste less grease along the right-of-way.

Here's How It Works

Four gear pumps, actuated by a ramp, deliver the lubricant through eight grease pipes to the chamber between the delivery plate and the rail, shown in section X-X.

Distributors on the delivery plate deflect the lubricant so that it is forced out of the delivery slot in a continuous line. The grease is thus picked up by the side of the flange in such a manner that the flange retains the maximum amount of lubricant on the surface coming in contact with the high rail of a curve and a minimum amount is wasted.

The operating parts of the Racor Rail Lubricator are of substantial construction, with flexible connections, and require only periodical inspection to see that the grease reservoir is filled and the few operating parts exposed to the weather are kept oiled.


GREASE DELIVERY SLOT 9'-2⅞" LONG DIVIDED INTO 8 DELIVERY SPACES (EACH 12⅞" LONG) BY SHIMS AT BOLTS WHICH MAINTAIN THE WIDTH OF DELIVERY SLOTS ACCURATELY.
DELIVERY PLATE
FILLER PLATE
GREASE DISTRIB-UTOR
GREASE PIPE
GASKET

SECTION X-X

RAMAPO AJAX CORPORATION

CANADIAN RAMAPO IRON WORKS, LIMITED

RACOR TRADE MARK REGISTERED

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HILLBURN, NEW YORK
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NIAGARA FALLS, ONT.
PUEBLO, COLO.
SEATTLE, WASH.
SUPERIOR, WIS.

Building up battered rail ends *by Welding* makes old rail *as smooth as new*

Building up the rail end by depositing weld metal.

Shaping the weld metal roughly to rail contour.

Battered rail ends built up by the Oxweld process wear better than new. The deposited weld metal is harder than the original rail. Thus a smooth-riding rail is obtained at a small fraction of replacement cost. During the past year, many thousands of rail joints were renewed in this easy, economical way under Oxweld Railroad Service supervision.

In this and many other ways, Oxweld Railroad Service is helping toward the profitable operation of American railroads. Through almost a quarter of a century, The Oxweld Railroad Service Company has served the welding and cutting needs of a majority of Class I railroads.

THE OXWELD RAILROAD SERVICE COMPANY

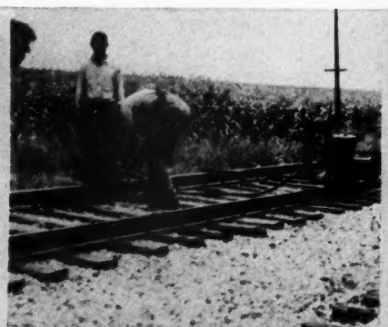
Unit of Union Carbide and Carbon Corporation

New York: Carbide and Carbon Building

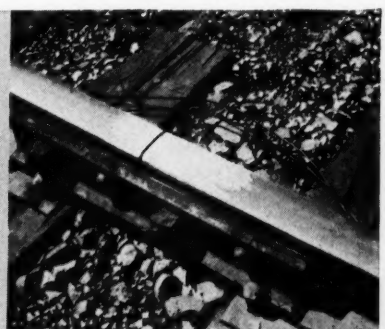
UCC

Chicago: Carbide and Carbon Building

Surface grinding the rail ends to the level of the rail.



Cross grinding the rail ends to allow for expansion.



The finished rail ends are as smooth as new.

OXWELD RAILROAD SERVICE

PERFORMANCE ON THE JOB COUNTS

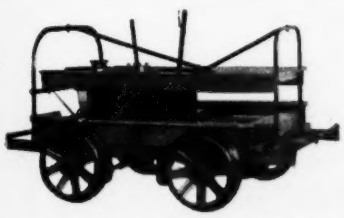
M14 SERIES D ALUMINUM

LIGHT SECTION CAR . . . LIFT ONLY 96 POUNDS!

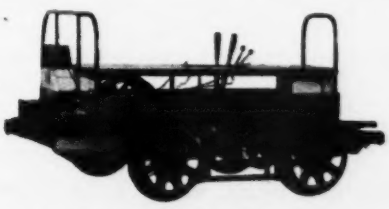
Think of it! 70% less lifting effort than required to handle the nearest comparable car. Sound engineering design makes possible a full-sized, full-strength section car for summer section crews of 6 to 8 men . . . yet light enough for single man operation. The Fairmont M14 is such a car—virtually two cars in one—because it definitely covers this wide range of service. And there is nothing revolutionary about the M14. Its fundamental design is typically Fairmont. It has safe and ample accommodation for full crew and equipment. The application of modern aluminized construction reduces the weight to a record low lift of *only* 96 pounds. For a surplus of power to match its tough rugged construction, this M14 is equipped with the famous Fairmont Model O Engine . . . the same power plant that has proved its economy and dependability on five other Fairmont cars.

Fairmont takes pride in the fact that it pioneered aluminized construction in railway motor cars with this M14 and that its performance has pointed the way to a new low in two-way economy . . . on the score of both initial investment and operation costs. Fairmont Railway Motors, Inc., Fairmont, Minnesota.

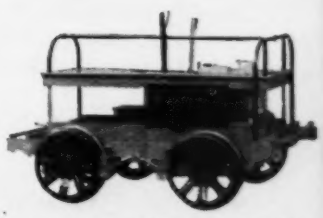
Inspection Motor Cars . . . Section Motor Cars . . . B & B and Extra Gang Cars . . . Gas-Electric Ditchers . . . Shapers . . . Ballast Cleaners . . . Ballast Drainage Cars . . . Mowers . . . Weed Burners . . . Extinguisher Cars . . . Power Cars: Air, Electric, Paint Spray, Tie Tamping . . . Rail Coaches . . . Motor Car Engines . . . Push Cars and Trailers . . . Roller Axle Bearings . . . Wheels and Axles.



● S2 Series D—Standard Section Car



● M14 Series E—Light Section Car



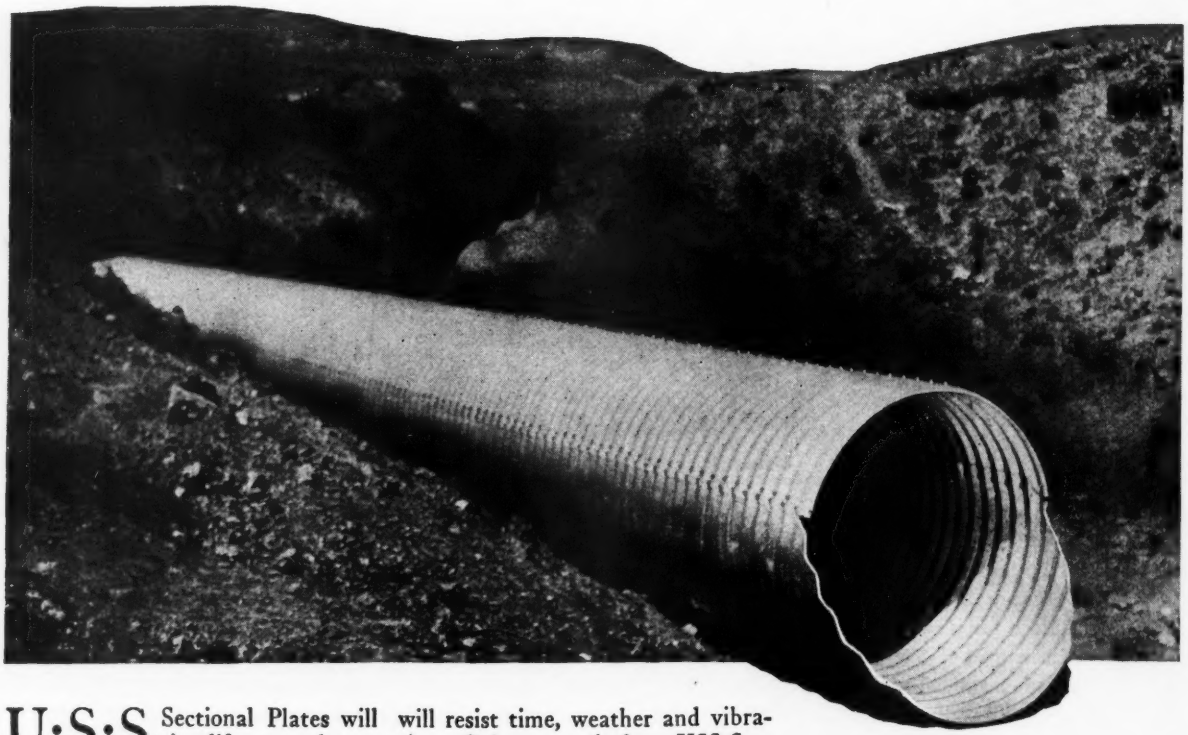
● S2 Series C—Section-Car Car

FALL THE RAILWAY MOTOR CARS IN SERVICE TODAY

Fairmont

More than Half are Fairmonts

Here's how U·S·S AMERICAN SECTIONAL PLATES reduce Labor...save Time and Money



U·S·S Sectional Plates will simplify your larger culvert construction for you and do it at reduced cost. This material is easy to erect, shoring and foundations are rarely necessary. No skilled labor is required to put it in place and no costly tools needed. In their manufacture USS Sectional Plates have been designed to fit together quickly and easily.

When the culvert is completed you have a sturdy durable structure that will resist time, weather and vibration. Culverts made from USS Sectional Plates are easily adapted to landscape improvement and are therefore attractive as well as economical.

USS Sectional Plates are made from carefully selected base metal which has a heavy coating of zinc applied by means of the hot-dipped galvanizing process. The galvanized coating gives added protection against corrosion to the durable base of copper-steel. This material has given highly satisfactory results when used for small bridges, all types of sewers, for enclosing small streams, for conduits, for safety underpasses, for replacement of unsafe or damaged structures and other similar uses. It will pay you to investigate the application of USS Sectional Plates to your particular problem.

U·S·S AMERICAN SECTIONAL PLATES

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Products Company, New York, *Export Distributors*

Copper-Steel Galvanized Sheets for smaller conventional types of roadway and drainage culverts are also made by:
Carnegie-Illinois Steel Corporation, *Pittsburgh-Chicago*
Columbia Steel Company, *San Francisco*
Tennessee Coal, Iron & Railroad Company, *Birmingham*

UNITED STATES STEEL

MOLES

Clean Ballast Without Obstructing Tracks

SAFETY and ECONOMY, with increase in train speeds and number of train units, makes doubly important maintenance equipment which does not occupy running track.

THE MODERN MOLE meets all requirements for safety, efficiency and operating costs.

DEMOUNTABLE DERRICK, newly developed, permits moving of either Intertrack or Border Mole any distance with regular operating crew, eliminating all necessity for work train.

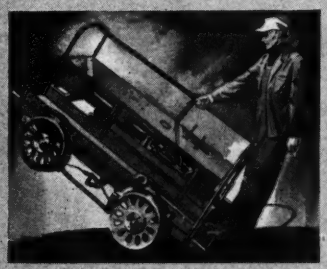
RAILWAY MAINTENANCE CORPORATION

Pittsburgh, Pa.

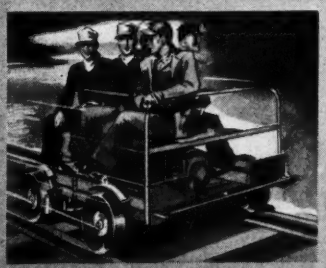
SAFE SPEED—LIGHT WEIGHT
—AND ADEQUATE CAPACITY

mark the Sheffield 49

A Sheffield 49, fully loaded, operates at satisfactory speeds with its powerful 8-hp. engine.



One man can counterbalance a Sheffield 49 by stepping on its lifting handle. One swing takes it off the rails. Lifting weight is 164 pounds without troublesome lifting handles.



A Sheffield 49, complete with standard windshield, will carry six men and their tools—AND pull a trailer with 4000-pound pay load at 15 miles per hour.

Here's *the* car for 1937 section work! 4-wheel brakes. Air-cooled, forced draft engine. Indestructible clutch. These and many other features make the Sheffield 49 ideally suited for section car service on *any* division. For full information, ask for Bulletin D731. Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.

8901-RA21.104

FAIRBANKS MORSE

POWER · PUMPING AND WEIGHING EQUIPMENT

F M

Railway Equipment

TO MAINTENANCE COSTS

HERE'S A QUICK PERMANENT WAY TO END REPAIR BILLS AND IMPROVE SAFETY

• These pictures tell the story. Instead of spending money for further repairs on this dangerous trestle, the railroad wisely replaced it with 100 feet of Armco Multi Plate Pipe—90 inches in diameter.

Built of heavy iron plates with extra large corrugations, this huge pipe has ample strength to support the 35-foot fill eventually placed over it. Moreover, since these plates are Armco Ingot Iron, the new structure may be counted upon to last a lifetime—without upkeep or repairs.

If any of your trestles or large culverts are in bad condition, decide now to replace them with Armco Multi Plate—either in full-round or arch design. Our nearest office is ready to give you capable and helpful assistance.

INGOT IRON RAILWAY PRODUCTS CO.
Middletown, Ohio • Berkeley, California

(Member of the Armco Culvert Mfrs. Assn.)

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ARMCO MULTI PLATE

The Reflection of Endurance In Modern Railway Maintenance Equipment

The Timken Bearing Equipped symbol reflects long life and dependability in every piece of railway maintenance equipment with which it is associated.

In leading makes of section motor cars and trailers, Timken Bearings protect the wheels against radial, thrust and combined loads; hold them true to gauge; prevent wheel breakage; eliminate friction; simplify lubrication; and cut car maintenance costs to the bone.

To make sure of getting the same endurance in your new section cars as in modern main line locomotives, cars and streamlined trains, look for Timken Bearings—and the Timken Bearing Equipped symbol.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN *TAPERED ROLLER* **BEARINGS**

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TRACK *Surfaced with* I-R TAMPERS

STANDS UP UNDER *Heavy Traffic*

INGERSOLL-RAND Pneumatic Tie Tampers strike uniformly powerful and effective blows throughout the entire working day—heat, cold, fatigue and other physical conditions that disrupt the uniformity of human labor are not a problem when these tools are used—"morning, noon or night," they do their job with the same unexcelled efficiency.

Working opposite, in pairs—striking steady blows of constantly equal intensity—Pneumatic Tie Tampers compact the ballast solidly under the ties—eliminate water pockets—and produce a smoother riding, safer, more permanently and more uniformly tamped track, than by any other known method.

Furthermore—it has been thoroughly demonstrated over and over again, that track resurfaced by means of I-R Pneumatic Tie Tampers retains its alignment and lasts much longer, under even the heaviest kind of high-speed traffic movements.

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Washington

No. 97 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: A HAPPY NEW YEAR

January 1, 1937

Dear Reader:

As we start the new year, I want first of all to express appreciation for the co-operation that we have received from you during the last year. It has been a year of rapid changes in transportation practices, changes that have taxed the versatility and adaptability of many of you. We have tried to aid you in meeting these new conditions by uncovering and bringing to you descriptions of those new ideas, materials and methods that individual men here and there have found meritorious.

We extend the greetings of 1937 to the more than 7,000 of you who, as subscribers, constitute our direct audience. You have renewed your subscriptions with a unanimity that is most gratifying. On many roads every supervisory officer is a subscriber; the number of omissions on the roads as a whole is so small as to be almost negligible. With many of you we have maintained a relationship of reader and editor for more than a quarter of a century.

We extend equally hearty greetings to those alert merchandisers of materials and equipment whose messages have come to you throughout the year. By their increasing use of our advertising pages to bring their products to your attention, these manufacturers are showing their appreciation of the importance of your market and of the position that you hold in the selection of their materials. Their advertisements constitute a constructive addition to our editorial pages. Like you, not a few of our advertisers have been with us for years.

To all of you, subscriber, reader and advertiser alike, we express appreciation for your co-operation during 1936. We hope to merit and receive the same whole-hearted teamwork during 1937. For our part, we pledge still greater effort in "covering" the developments in your field and ours. We wish for each of you a Happy New Year.

Yours sincerely,

Elmer T. Howson

ETH*JC

Editor

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To reduce stock claims . . .

fence the Right-of-Way

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The best way to reduce stock claims is to fence the Right-of-Way. The most economical protection is offered by American Railroad Fence and Banner Steel Line Posts. These products, including National Expanding Anchor End and Corner Posts, meet all specifications of the American Railway Engineering Association.

American Railroad Fence is made of medium hard wire, tough and sturdy. It is full gauge with rust resisting Copper Bearing Steel. The smooth, evenly coated galvanizing affords a full measure of protection against corrosion. The famous American Hinge Joint gives the flexibility that is necessary to withstand the heavy pressure of live stock. The use of these products is not only insurance against the adjustment of costly stock claims, but protection for life and property. Write for a personal consideration of your problems.

AMERICAN RAILROAD FENCE *and* BANNER STEEL POSTS

AMERICAN STEEL & WIRE COMPANY, *Chicago-New York* · COLUMBIA STEEL COMPANY, *San Francisco* · TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

TRUSCON*IZE* HIGHWAY CROSSINGS

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TRUSCON STEEL COMPANY
YOUNGSTOWN • OHIO

Compare the rough, "unfriendly" crossing (at top of illustration) with the smooth, safe and friendly" Truscon Weltrus Crossing in this photograph.

* SAFETY FIRST- *friendliness too!* WITH TRUSCON WELTRUS HIGHWAY CROSSINGS

*Famous slogan of the Association of American Railroads

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Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

January, 1937

Editorials - 19
1936—A Year of Recovery

Special Gangs Apply Ties on Union Pacific - - - - - - - - 22
Gangs of 24 men and a foreman organized each spring insert ties in main tracks of most lines of the system

What We Have Done - - - - - - - - - - - - - - - - - 25
The contributions that the maintenance of way department has made to railway efficiency and economy are reviewed by L. A. Downs

Costs and Economies of Curve Lubrication - - - - - - - - - 27
T. E. Rodman outlines a method for determining the cost of rail and flange lubrication and discusses the economies to be derived

A Unique Skylight Problem - - - - - - - - - - - - - - - 28
Pennsylvania removes approximately 60,000 sq. ft. of glass in work on roof of station in New York—New features of design

Concrete and Steel in Trestle Construction - - - - - - - - - 33
R. P. Hart submits an outline of the reasons for substituting these materials for wood in the smaller railway structures

How Many Fire Extinguishers? - - - - - - - - - - - - - - 35
Considerations influencing the choice of fire-fighting equipment for various classes of structures are discussed by W. A. Radspinner

"It's Up to You" - - - - - - - - - - - - - - - - - - - 36
Unique safety-first practices are effective in reducing accidents to men under jurisdiction of Section Foreman Hesterly on Southern Pacific

N. & W. Track Awards - - - - - - - - - - - - - - - - - 37
As the outcome of its 1936 inspection, this company paid cash prizes totaling $2,090 to 83 foremen

What's the Answer? - - - - - - - - - - - - - - - - - - 38

New and Improved Devices - - - - - - - - - - - - - - - - 45

New Books - 47

News of the Month - - - - - - - - - - - - - - - - - - - 48

ELMER T. HOWSON
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Associate Editor

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Business Manager

in 1933 these expenditures were only 37.6 per cent as large as the average for the four years 1926-1929. They reveal also the extent of the recovery that has taken place during the last three years, and especially during 1936, for in this latter year the expenditures exceeded those of

Maintenance Expenditures (1917-1936)

1917	$ 442,108,862	1927	$868,581,432
1918	649,794,953	1928	837,905,747
1919	772,186,045	1929	855,354,867
1920	1,032,540,381	1930	705,470,940
1921	756,413,690	1931	530,612,890
1922	728,663,534	1932	351,179,041
1923	813,688,760	1933	322,335,022
1924	792,678,023	1934	365,285,353
1925	816,443,205	1935	393,642,261
1926	866,819,365	1936*	455,000,000

*Last two months estimated.

1933 by more than $132,000,000, or 42 per cent. However, even with the increase that has taken place, the expenditures were less than in any post-war year prior to 1932 and were still 47 per cent below the 1926-1929 average.

Such figures immediately raise questions regarding the adequacy of the present scale of maintenance and also regarding the amount of under-maintenance that has accumulated. If one should take the 1926-1929 annual expenditure for maintenance of way of $857,165,353 as normal, the total deficiency since 1929 now reaches the enormous total of $2,875,000,000 or more than three full years of normal pre-depression expenditures. Such a figure is, of course, grossly excessive as we pointed out in a corresponding review of the status of maintenance expenditures a year ago, for it takes no account of the decreased wear and tear resulting from the smaller traffic, of the almost complete elimination of charges incident to improvement work, of the increased efficiency of labor and the longer life accruing from the investment made in more permanent materials during the 1923-1929 period of widespread improvement, or of the means that have since been developed to secure increased efficiency from both labor and materials.

That these factors are of large proportion is evident. The determination of the magnitude of their influence is not, however, capable of accurate calculation. After making what appeared to be ample deductions, we estimated a year ago that there was then an accumulated deficiency in maintenance of fixed properties approaching $1,000,000,000.

The Present Situation

During the last year, the railways spent approximately $90,000,000 more for maintenance of way and structure than in the preceding year. This was highly beneficial to the properties. However, it cannot be contended that an expenditure 47 per cent below the average for 1926-1929 is adequate to make good the wear and tear of a traffic that was only 24 per cent below the 1926-1929 average, especially when recognition is given to the increasingly exacting requirements of this traffic and the greater wear and tear on the properties resulting from the higher speeds with which this traffic (freight as well as passenger) moves today. Rather, it is apparent that the expenditures made last year were still inadequate to meet the needs of the properties, although the deficiency was reduced materially from that of the years immediately preceding, and that our estimate of $1,000,000,000 accumulated deficiency in maintenance, made a year ago, is even more conservative now.

This does not mean that the railway properties are approaching a dangerous condition for a railway is made up of a wide variety of facilities, only part of which, like the tracks and bridges, enter directly into the movement of traffic. In the six years of curtailed appropriations for maintenance, forces have, of necessity, been required to apply such funds as were available to the upkeep of these traffic-handling facilities, to the neglect of other facilities. Expenditures on branch lines have been curtailed more severely than on main lines.

As a result of this policy of concentrating expenditures largely on the main line tracks and structures carrying high-speed traffic, the railways have not only maintained but have raised their already high standards for safety and regularity of service. The success that has followed their efforts constitutes an evidence of managerial efficiency that has never been excelled. But even this record, remarkable as it is, should not cause one to lose sight of the deterioration in facilities, other than in main line tracks and structures, that is still progressing, and at an accelerated rate, and that must be made good in the near future if abnormal maintenance is to be avoided.

Rail Orders

One evidence of the recognition by railway managements of the inadequacy of their maintenance programs of recent years and of the necessity for correcting this condition at the first opportunity, is afforded by the magnitude of the orders for rails that were placed during the closing weeks of 1936 for delivery and laying during 1937. Expedited in part by an announcement of an increase in price of $2.625 a ton, effective December 1, more than one million tons of rails were ordered, principally of 112 lb. and 131 lb. sections for laying in main line tracks. With the supplementary orders that will be placed later in the year by these and other roads it is evident that the year will see a marked strengthening of main tracks.

For purposes of comparison the tonnage of rails laid in replacement in recent years follows:

	New Rails Laid In Replacement		New Rails Laid In Replacement
1923	1,660,000	1930	1,517,002
1924	1,720,000	1931	984,900
1925	1,870,000	1932	394,536
1926	2,120,000	1933	403,254
1927	2,124,765	1934	631,093
1928	2,080,277	1935	582,794
1929	1,958,489	1936 (estimated)	950,000

It is evident from the above that there is a large accumulated deficiency in rail replacement since 1930, even after allowance for the reduced wear and tear resulting from the smaller volume of traffic and for the measures that have been developed in recent years to increase the life of rail. A year ago we estimated the deficiency in rail replacement necessary to restore the tracks to their 1929 standards of 3,500,000 to 4,000,000 tons. We believe this estimate to be conservative as of today.

Another measure of the adequacy of track maintenance is afforded by the renewal of crossties. Here the deterioration is less affected by variations in traffic and has continued more uniformly throughout the depression, as

contrasted with rail. On the other hand, the increasing use of treated ties in the years preceding the depression has increased the life of these ties and postponed renewals, an influence that has stood the roads in good stead during the last six years. Crosstie renewals during the last 17 years follow:

1920	86,829,307	1929	74,679,375
1921	86,521,556	1930	63,353,828
1922	86,641,834	1931	51,501,659
1923	84,434,985	1932	39,190,213
1924	83,073,059	1933	37,295,716
1925	82,716,674	1934	43,306,205
1926	80,745,509	1935	44,351,900
1927	78,340,182	1936 (estimated)	48,300,000
1928	77,370,491		

As with rail these figures indicate a pronounced deficiency in replacements. Two years ago we estimated this deficiency at 85,000,000 ties. Little progress has been made in correcting this condition. The hopeful feature, here, as with rail, is the evidence of realization by railway managements of the necessity for more liberal renewals at the first opportunity. A factor of concern for the future is the possibility that the roads may face a shortage of ties when they enter the market for materially increased requirements, since an interval of approximately a year is required to produce, season, treat and deliver a tie ready for insertion in the track and production of the better grades of ties cannot now be speeded up quickly. This situation constitutes a warning to forehanded maintenance officers to anticipate their requirements more than normally.

Other Maintenance Deficiencies

But it is not with rail and ties that retrenchment and under-maintenance are most pronounced. Rather it is in that wide variety of activities that do not directly concern the safety of travel but are reflected more largely in economy of maintenance and operation. In such activities as the upkeep of buildings, the replacement of obsolete work equipment with units of newer design, the modernization of water service equipment and the reconstruction of structures to adapt them to changed conditions of traffic and operation, all essential to the proper and efficient functioning of a modern railway, expenditures have been at a standstill for six years. It is here that the greatest increases in activity will be recorded as money becomes available, for there is a limit beyond which such work can no longer be postponed.

Keeping pace with expenditures, the forces employed in the maintenance of roadway and structures were larger than in the corresponding period of the preceding year in every month except January. The average monthly force (for the year to November 1) approximated 227,000 men, as compared with an average of 209,000 for the same months of 1935. In this connection it is interesting to note that during the four years 1926-1929 inclusive, this force averaged 412,777, while in 1933 it had declined to 198,038. It may be noted also that for the sixth successive year the *maximum* force in any month was less than the normal winter force in any post-war year prior to 1930. There was little change in basic organization of forces during the year, although the trend continued towards the concentration in specialized gangs of such work as the renewal and tightening of bolts that was formerly handled by section forces.

Aside from the marked trend towards recovery in the second half of the year, the outstanding development was the widespread extension of high speed train operation. During the last year 14 of these new fast trains were placed in service in the United States and 8 in Canada, while 10 more were ordered late in the year for installation next spring. With the trains already in service, the railways of the United States and Canada will have 46 streamlined trains in service before the middle of the summer.

As a result, the American railways are now operating a larger number of trains scheduled at speeds of more than 60 miles per hour than any other country in the world. Furthermore, the have more trains whose schedules require operating speeds of 80 miles per hour or more, while two of these trains regularly reach speeds of 108 miles per hour on their routine schedules. The added patronage attracted to these trains, much from other transportation agencies, insures that they will continue to increase in number as well as in areas served. These trains are indicative of the faster schedules that are being established for other passenger trains and for freight trains as well, characterizing the new era of rail transportation in which we are entering.

The relation between these schedules and the tracks over which they operate is direct. No schedule can be better than its track. Higher speeds require stronger track and greater refinements in construction and maintenance alike. These trains are ushering in a new day for maintenance forces as definitely as for those of the operating department. It is to the credit of maintenance forces that they have met these new conditions as successfully as they have to date.

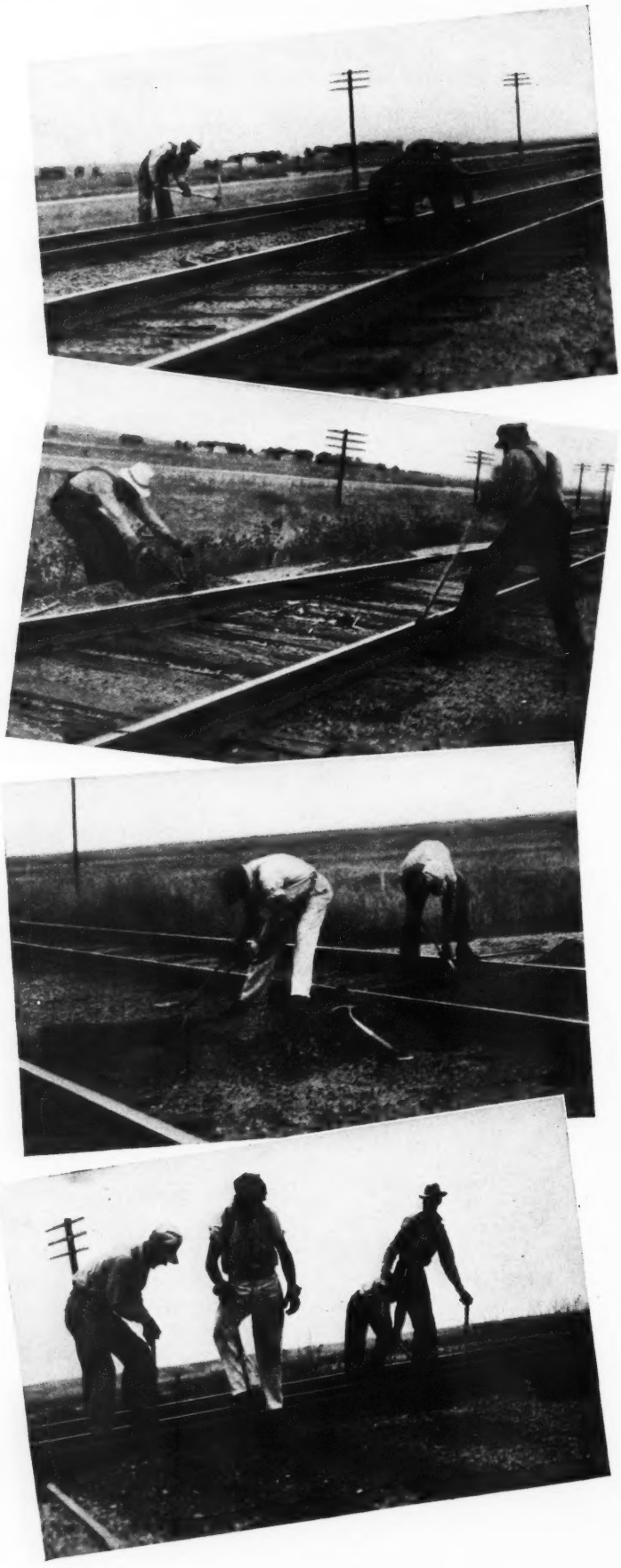
What of 1937?

Looking to the future, the prospects are more optimistic than at any time since 1929. General business is improving and this is increasing railway traffic. All indications point to the continuation of the recovery that attained such momentum during the closing months of 1936. Increased traffic has long been the pressing need of the railways. With it, many of their other problems will disappear.

Increased earnings are invariably followed by more liberal appropriations for maintenance. The rail orders that have already been placed are an indication of the markedly larger programs that are now in the making—programs that, from an examination of budgets already completed, show increased expenditures for maintenance approximating 16 per cent or more and going into more diversified channels than has been possible of late.

The railways are emerging into a new day—with speeds that were unthought of only a decade ago—with diversification of service on highway as well as rail—with refinements that create more exacting and more diversified demands on maintenance forces than have ever been faced before. And these demands must be met while at the same time maintaining and intensifying the search for greater efficiency in materials and in methods in order that these super-services may be provided at a price which the public is able to pay.

The railways are in the dawn of a new era. Engineering and maintenance forces have an essential part in meeting the demands of the day.



Special S

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TIE renewals in main tracks of the Union Pacific are now made largely by special tie gangs, the application of ties by section or yard gangs being confined to side and yard tracks and to the main tracks on minor branches or portions of other lines where the renewals are light. Applied to a limited extent in 1932, this plan was extended from year to year, and since 1934 it has been followed on the entire system. A contingent feature of the plan is the unloading of the ties by gangs that travel over the road with tie distributing trains according to a routing that is definitely co-ordinated with the schedules laid out for the renewal gangs.

Use Small Gangs

This plan of the Union Pacific is to be distinguished from that followed by certain other roads in that these gangs are concerned solely with tie renewals. Ordinarily they do no surfacing, deviation from this rule occurring only where exceptionally heavy renewals result in uneven surface. Another distinctive feature is the relatively small size of the gangs—24 men and a foreman—a sufficient number of units being organized each season to complete the tie renewals to be made by this force.

The primary reason for adopting the new organization was to decrease the labor cost of applying ties. In tracks ballasted with Sherman Hill gravel the gangs insert from 11 to 12 ties per man per 8-hr. day, while in cinder ballast (on branch lines)

Four Operations in the Renewal of Ties—Digging Out the Cribs, Pulling Out the Old Ties, Pulling in the New Ones, and Shovel Tamping. Two Other Steps in the Procedure Are Illustrated on Another Page

System Gangs

Apply Ties on Union Pacific

from 13 to 14 ties are renewed per man per day. This output is obtained without instituting any measures, such as competition between gangs, designed to stimulate maximum production at the sacrifice of the quality of the work done.

This performance, compared with an average of one tie per man-hour on section work, is the result of certain inherent advantages of conducting the work with the special gangs. The work is continued from day to day without the interruptions to which section gangs are subjected. It is the general practice to divide the procedure of renewing ties into a series of specific tasks—spike pulling, digging cribs, pulling ties out, etc., and to assign various members of the gangs to each of these tasks —often for the entire season—with the result that they become much more skillful at the particular jobs assigned to them than is the case where the same men perform all the operations involved in renewing ties. The men in these gangs are recruited from the section laborers, but because they are required to live in camp cars the jobs are not attractive to the older men, with the result that the men in these gangs are generally younger and more active than those in the typical section gang.

Other Advantages

A contingent advantage of the plan lies in the fact that it obviates the tendency for section gangs to neglect other track work during the active tie renewal period. It also insures that the renewals will usually be completed on the date set for the end of the tie renewal season, whereas considerable difficulty was experienced in the past in having the section forces complete their tie programs on schedule. Another advantage lies in the fact that tie renewal work is in progress at only one to three places at any given time on each roadmaster's subdivision, so that instead of being confronted with rough track resulting from tie renewals at some place on every section, he is forced to contend with it only at a few locations.

While the organization of the tie gangs has not relieved the section gang of all tie renewals, it has resulted in a sufficient reduction to warrant some curtailment in the section labor allotment. This has been effected by increasing the length of sections. Thus, double-track sections, which formerly averaged 3 to 5 miles of main line have been lengthened to an average of about 7 miles, while single-track sections have been lengthened from 7 or 8 miles to 11 or 12 miles, the number of men per section remaining approximately the same.

Gangs of 24 men and a foreman organized each spring insert ties in main tracks of most lines of the system. The plan has resulted in a reduction of the cost of application, while good workmanship is assured by placing the gangs under the supervision of the roadmasters as they work on the various subdivisions. All ties are distributed by district unloading gangs.

The organization of the tie distributing gangs had its inception in repeated complaints from the section men that they ruined their clothes in handling cresoted ties fresh from the treating plants. However, experience with a special gang organized in 1930 to distribute ties by work trains, not only removed complaints on this score but also proved that the plan is much more economical, the ties being unloaded for one-fourth to one-third of the cost of distribution by section forces. Still another advantage developed was the improved safety record. Regular employment in distributing ties enabled the men to become thoroughly conversant with safe methods of handling ties and to acquire skill in protecting themselves, with the result that these gangs have gone through an entire season without an injury resulting in loss of time. Furthermore, the combination of tie renewal and tie distributing gangs affords opportunity for a system of scheduling that insures the delivery of the ties sufficiently, but not too far, in advance of the arrival of the renewal gangs.

Selecting Ties

The selection of the ties for renewal is initiated by the section foreman, and is checked and revised by the roadmaster, while the estimates of ties required for renewals on each district are reviewed by the district engineer. The foreman marks the ties he has selected for renewal with a daub of paint, so that if his estimate of the tie requirements is cut, it is necessary for the tie gang foremen to determine which of the marked ties are to be left in track. As a matter of fact, he is authorized to replace ties other than those marked if close examination indicates that this is desirable.

The working schedules of the tie gangs are prepared without any regard for division limits. The season's program for the various gangs, as to the time of starting and completing their work and the territories to be covered, is determined after a study involving such considerations as the monthly allotments for maintenance of way expenditures, the allotment of territories that will entail the minimum of cross haul or loss of time in moving camp outfits and a co-ordination of the gang operation with the schedule for distributing the ties.

In accordance with this program the treating plants are furnished a schedule for the loading and shipment of ties in lots of 15 to 20 cars to points on the various lines where they can be picked up by the work trains assigned to tie distribution, having in mind that these deliveries should be made not more than a week in advance of the time that the work trains are scheduled to pick them up. Only two distributing gangs are employed, one on the eastern district (lines east of Ogden, Utah) and another on the southwestern, central and northwestern districts. Thus ample time is afforded for an orderly delivery of the ties along the routes covered by these gangs.

Start in December

The distributing gangs start their work early in December completing the distribution first on the southern lines of the system, where the renewals can be started earlier, and continuing progressively over other lines until all ties are distributed. The tie distributing gangs consist of

Bar-Tamping of the Ties After They Have Been Shovel-Tamped

20 men and a foreman and are provided with bunk cars and a boarding outfit that are moved in the work train with the tie cars, the latter being set out as they are unloaded and replaced by loaded cars at the various points of delivery. The train crews assigned to the work train stay with it to the end of their working jurisdictions.

Flat-bottom, open-top cars are used in this service for greater safety in handling the ties and to enable the foreman to exercise a degree of control over the unloading that would not be possible if the men were scattered through a train of box or stock cars. The foreman is supplied with a list of the ties to be unloaded per mile and effects the distribution by instructing each of the men, who are placed two to four in a car, to unload a given number of ties to each pole. An exception to this rule is made on high fills with narrow shoulders, the ties in such cases being unloaded at the ends of the fill. The tie-unloading gang distributes from 30 to 50 cars per day. Pending the arrival of the tie gang, the section gangs "straighten up" the ties, placing them on the shoulder outside the toe line and perpendicular to the track, except in cuts where they are laid on the slope outside the ditch.

Each tie gang is provided with an outfit consisting of a foreman's car, four bunk cars, a tool car and a tank car. The tools include no power equipment, owing to the fact that power tampers, the only type of machinery that could be applied in this type of work, have not been found adaptable because of the small amount of surfacing done and because their use in tamping the new ties would entail too frequent resetting of the power unit on account of the amount of ground covered by the gang in a day's time. Another reason is to be found in the type of ballast used on the Union Pacific main line. This is Sherman Hill disintegrated granite, a natural broken stone or gravel of small, hard particles, which is easily worked with shovels and tamping bars.

Gang Organization

In the course of the routine operation the men in the gang are distributed as follows, each man performing the same work each day.

1 man pulling spikes
5 men digging out cribs adjacent to ties to be removed
3 men pulling out old ties
8 men inserting and tamping the new ties
2 men installing the tie plates
2 men spiking the ties
3 men dressing the ballast and moving up the push car that carries the spikes, tie plates, spare tools and drinking water.

The foreman marks the ties to be removed and sees that the various units of the gang are spaced far enough apart to avoid interference and reduce the hazard of accidents. On double track the work is carried on simultaneously on both tracks. The pace is set by the men digging the cribs, each of whom is provided with a shovel and a pick and works by himself. They move ahead in regular order so that all men dig the same number of cribs. On the other hand, the foreman is afforded an immediate check on the quality of the work done by noting whether the men who take out the ties experience any difficulty because the cribs are not dug out deep enough.

The men who remove the ties work together. They are provided with tie tongs and two small jacks, and lift the rail to remove the tie plates unless the plates are so deeply imbedded in the tie that the track

The Tie Plates Are Inserted After the Ties Have Been Set by Train Action

would have to be lifted by an amount that would disturb the bedding of adjacent ties.

The eight men who insert and tamp the ties actually function as two groups of four men each—one group inserting and shovel-tamping the ties and the other tamping the ties with bars, the men working in pairs in all cases.

Two men with a small jack insert the tie plates and two others spike the ties, but these two groups work far enough behind the rest of the force to insure that the ties have been bedded in by train action before the tie plates are inserted.

Little Change in Routine

As the work done is of a nature that does not entail slow orders or the employment of flagmen, the routine is not disturbed for the purpose of getting the track in condition to allow trains to pass. As a consequence, the work continues from hour to hour with little deviation from the order of procedure described above, except where ties must be inserted at highway cross-

(Continued on page 26)

What We Have Done

By L. A. DOWNS
President, Illinois Central

The nature and magnitude of the contribution which the maintenance of way department has made to railway efficiency and economy during recent years were set forth in a challenging manner in an address which L. A. Downs, president of the Illinois Central System and a former maintenance officer of that railway, made before the members of the Investment Bankers Association at Augusta, Ga., on December 3. In that address Mr. Downs reviewed the progress which the railways have made in various departments in perfecting and improving their practices. That portion of his address relating to the achievements of the maintenance of way department is presented here.

THE severity of this depression, in its effect upon rail transportation, far eclipsed anything experienced in the past. By 1933 the railroads had been set back some 20 years in amount of annual revenue, some 30 years in volume of traffic. They had twentieth century needs and a nineteenth century income. Drastic reductions had to be made in operating expenses and they had to be made without impairing the service; in fact, while the expenses were being reduced, the service had to be improved to hold the business that was left and to win more business. It was an experience that our generation of railway men will never forget. They had to revise the standards that had been built up over the years by painstaking effort and get down to elementals. It was a job of re-education that required a lot of new thinking and hard work.

In the six years 1930-1935, compared with 1929, the Class I railroads made an aggregate reduction in expenses amounting to $10,194,000,000. In some part this reduction represents work that was put off because it could be put off without injury to the service. There were still other reductions in expenses that were made possible by the development and increased use of new and improved materials, modern tools and better methods and by fundamental changes in the art. These are mostly permanent economies extending into the future.

The Track

In describing the permanent economies that have been made by the use of modern methods of mass production, we might well start with the track, which is the basic part of the railway plant. Here we find an almost endless array of improvements that were developed or came into wider use during the depression years to improve the track structure and to reduce the cost of its maintenance and upkeep.

Notable improvements have been made in the manufacture of rails to make them harder and increase their service life. Most rail damage occurs at the joints, which are battered down under traffic. We formerly took up the rails when they became worn at the ends, sawed off the worn ends and relaid them in secondary tracks. This entailed the expense of removal and relaying and of course increased the number of joints. Now we build up the ends of worn rails

L. A. Downs

by the welding process, which prolongs the life of the rail fully one-third. Machines are used which generate their own power and can be moved from point to point along the track, making it possible to do this work without taking the rail out of the track and indeed under the heaviest traffic. In the five years 1931-1935 we built up the ends of some 5,000 miles of rails on the Illinois Central by the welding process. The same process is used on frogs and switch points, which were formerly scrapped when they became worn and are now virtually renewed by the welding process.

Fully 50 per cent of the expense of track maintenance is incurred at the rail joints. The same stresses which cause the rail to wear at the ends also cause the fastenings to work loose and the ballast to be disturbed. Anything that is done to lessen the number of joints makes for permanent economy in track maintenance and produces a collateral saving by reducing the shocks on the equipment. One thing that has been done has been to lengthen the standard rail from 33 ft. to 39 ft., reducing the number of joints in the track by 18 per cent. Another thing that has been done has been to weld into a single piece long stretches of rail in crossings, on bridges, in tunnels and elsewhere. This has been done experimentally on stretches up to one mile in length, with such success as to hold promise of additional permanent economies in the future.

Wood Preservation

The treatment of ties and bridge timbers has produced large permanent economies. Treatment just about trebles the service life of such material—from 10 to 30 years in the case of bridge timbers, from 6 or 8 to 20 years in the case of ties. Treatment of ties and timbers began some

years ago and has progressed as renewals have been made, and the full effect of this modernization has come to be realized only in recent years.

There was a time when practically all work that was done on the track was hand labor. The pick and shovel were the recognized symbols of the craft, and truly the trackman earned his bread by the sweat of his brow. First came steam shovels, then pile drivers, to do some of the heaviest track work. Then other machines were developed, primarily in response to the demand of the men in charge of roadway maintenance on the railroads, and their numbers and use have been gradually extended until practically all track work has been mechanized,

Rail Laying

Laying rail is now a mechanical operation. Spikes are pulled by machine, the old rail is taken out of the track by machine, grooves for tie-plates are cut in the new ties by machine, the new rail is put in place by machine, and the bolts are tightened and the spikes are driven by machine. With these modern methods it is possible to lay rail with about one-forth of the number of men that were formerly required, and the cost has been reduced to about one-third of what it was.

Track surfacing also is mechanized. Machines are used to loosen the ballast, other machines are used to clean and renovate it, and still other machines are used to tamp it back into place. It is possible to turn out some 50 per cent more work per man-hour in this fashion, and it is uniformly better work. Machines also are used for buring weeds, mowing waylands, grading shoulders and ditching and banking.

One of the most expensive jobs in roadway maintenance in the past was to keep switches in working order in blizzard weather. On a busy terminal it took two men to every switch stand. The work was difficult, accidents were numerous, and there were many delays to trains. On busy terminals oil and electric heaters are now used at switches which melt the snow as it falls, and elsewhere blow torches are used to keep switch points clear. With these improved methods it takes a handful of men to do work that once required a small army, and the change has reduced accidents and avoided train delays, with additional savings.

The improvement in the track structure that has been brought about by better materials and better tools has also made it possible to effect permanent economies in the expense of supervision. The old track structure required constant attention; it took a section foreman and a gang of men working long hours to keep up even a small section of track. With the present track structure and the improved tools that are available, it is now possible for a section foreman to cover twice as much territory as formerly, do it with fewer men and do it more thoroughly and more efficiently. On the Illinois Central the number of track sections has been reduced from 1,322 to 680, and the supervision is better than it was before.

Improved methods of water treatment and the regular blowing off of boilers on the road and at terminals remove the impurities and prevent scale and corrosion, and so extend the life of boilers, flues, fireboxes, staybolts and other parts. The service life of flues has been doubled—from 6 to 12 years, on the average—by these methods. The average service life of fireboxes has been lengthened 6 years or more. Before 1929 we had to rebuild 115 fireboxes a year; since then we have averaged 15 a year.

In 1921 the operating cost of moving a ton of freight a thousand miles was $10.78. In 1929 it was $7.44. With the decline in volume since 1929 it might be expected that the unit cost would increase, but instead of that it was further reduced to $6.63 in 1935. Considering the permanent economies which will continue into the future, the unit cost will certainly be further reduced with increased volume.

Research

Opportunities for permanent economies on the railroad have not been exhausted. Research is going on all the time. To illustrate: Rails are being tested in the laboratory sustained by the railroads at the University of Illinois. Rails are also being tested in the track by the use of detector cars which locate hidden fissures within the rail. Each railroad also has its own research program, going into all manner of materials and practices. These efforts are further supplemented by the research activities that are constantly being conducted by the manufacturers of the tools and materials which the railroads use in such large quantities. And it should also be said that not all research work is done in laboratories. Every railway man who goes about his job with an alert and questioning mind is, in the best sense, a research worker, seeking new ways to improve the service and cheapen the cost of producing it.

Special Tie Gangs

(Continued from page 24)

ings, or where it is necessary to drop back to do surfacing at points where the renewals have been bunched to an extent that results in rough track.

While new ties are inserted in place of all ties removed when work is discontinued at the end of the day, the cribs are left open at night, except at the ends of passing tracks or other points where open cribs or piles of ballast on the shoulders might constitute a hazard for train men. As a consequence, little time is lost in the morning in opening up the work.

Scheduled for the Year

The work of the tie gangs is scheduled for the entire season on a sheet that indicates the territory to be covered by each unit, the date it is to start work, the ties to be inserted and the approximate date of the completion of its work. Progress made in carrying out this schedule as well as the current expenditures are checked by means of daily reports made out by the foremen that show the number of ties inserted and the number of men worked.

The administration of the work of the tie gangs is carried out under a plan that definitely disarms the criticism that is often advanced when it is proposed to turn over to system gangs work that has long been considered the prerogative of the section gangs and for which the division maintenance organization is held responsible. While the tie gangs move from one roadmaster's territory to another as they carry on their work, each gang is under the direct supervision of the roadmaster of the territory on which it is at work and the foreman is required to carry out the instructions of the roadmaster until his gang is moved into the jurisdiction of another roadmaster. Each roadmaster is thus in control of the quality as well as the quantity of work done to exactly the same extent as when the renewals are made by the section forces, but with the added advantage that he is afforded a better opportunity to exercise close supervision, since the work is in progress at only a few locations on his subdivision at any given time.

Comparing the Cost and Economies of Curve Lubrication

By T. E. Rodman

General Manager, Maintenance Equipment Company, Chicago.

NEARLY 100 railroads in this country are now protecting high rails in curves against flange wear by means of rail and flange lubricators installed in track and actuated by the wheels of the passing trains. Such lubrication has been provided for a sufficient time to permit an accurate determination of the cost as well as the economies resulting from the reduction of flange friction between the train wheels and the high rails in curve track.

Follow Different Rules

A number of railroads that are large users of rail and flange lubricators have computed the costs of protecting the high rail in curve against flange wear. Unfortunately, such costs apply only to the particular railroad compiling them, and therefore cannot be applied generally. Local conditions of curvature, grade, traffic and train speeds vary on all roads, so that it is difficult to set a general rule by which rail lubricating costs may be estimated by prospective users of rail and flange lubricators.

Some railroads have computed their rail lubricating costs per ton of traffic handled through the lubricated districts. Others have arrived at figures for the rail lubricating costs per mile of curve track protected against flange wear. In the first case the cost per ton of traffic handled is not linked with the mileage of curve track protected. In the second case no information is given regarding the number of cars passing through the lubricated district.

In order to compare the operating costs of rail and flange lubrication, the number of wheel flanges lubricated by the lubricator in the track during the year should be determined. The cost of lubrication can then be based, first, upon the annual cost per thousand wheel flanges lubricated, and, second, on the cost per mile of high rail adequately protected against flange wear. The figures for comparison will then be the annual costs per mile of curve lubrication per thousand wheel flanges lubricated. These will serve as a more accurate means of comparing rail lubricating costs than is possible by any of the lubricating cost figures given by the railroads to date.

In estimating the economies for prospective rail and flange lubrication in a given territory, the problem in general should be approached from the standpoint of the increase in the life of the high rail in curves, due to the reduction in flange wear.

Nearly 100 Railways in this Country Are Protecting Curve Rails Against Wear

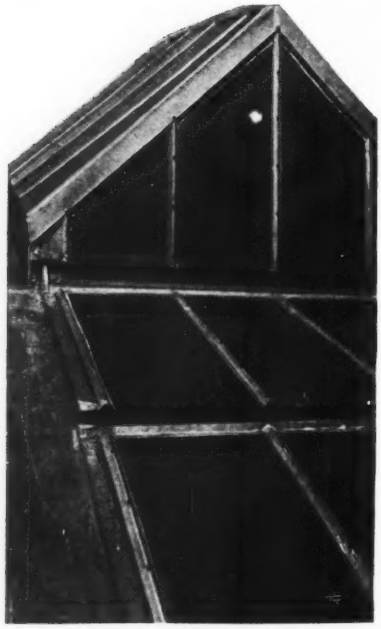
The amount of high rail adequately protected against flange wear by each lubricator will depend upon local conditions of curvature, grade, train speeds, etc. It will be best to consult a representative of the manufacturer of the lubricator before deciding upon the number of machines needed for the particular territory to be lubricated and upon their approximate locations. In territories where the degree of curvature is high, the length of high rail protected will be less than in territories where the rate of curvature is less. It should be borne in mind that the question is not how far the lubricant carries, but how much high rail is protected against flange wear. There are a number of cases where curves up to 15 miles away from a lubricator are well protected by it against flange wear. The total length of high rail lubricated in such a district, however, may vary from 3,000 to 12,000 ft., depending upon the length of the tangent tracks and that of the rail in curves not subject to flange wear. Lubricators are located so that the amount of high rail between them will be well protected against flange wear.

Estimating Annual Cost

Having determined upon the number of lubricators required in a territory, the total annual cost of lubrication may be closely estimated, knowing the number of car wheels that pass over each lubricator daily. The total annual cost per lubricator consists of the annuity to replace it in track at the end of its useful period in service, plus the total operating costs for the machine. An investigation of the performance of more than 2,000 grease lubricators of one type which have been installed during the past seven years indicates that the annuity period for these lubricators should be at least 10 years. The variable costs for the lubricator consist of the expense for labor to charge it with lubricant, to clean it periodically and to make necessary adjustments in order to have the feed correct for the class of traffic passing over it and the outlay for repair parts and for the labor for applying such parts. The operating costs will be found to vary according to the number of wheel flanges supplied with grease by the lubricator—that is, provided that lubricators are well maintained and are properly located in track. Repair part costs may be slightly greater in territories where speeds are exceptionally high.

Having estimated the total annual cost of rail lubrication in a territory, the decrease in the total annual cost of high rail in the territory should be estimated. The ratio of the sum of the annual cost of lubrication and the total annual cost of the lubricated high rail, to the total annual cost of the high rail if unlubricated, will indicate the economy of rail lubrication in-so-far as it relates to the protection of the rail. The life of high rail in curves provided with adequate lubrication, in general, should be at least three times that of the rail if unlubricated, although marked economies can be shown if rail life is merely doubled. A further economy, from the standpoint of track maintenance, results from the marked reduction in the outlay for regaging

(Continued on page 37)



A Unique Skylight

Pennsylvania removes approximately 60,000 sq. ft. of glass in work on roof of station in New York—New features of design are incorporated

Above — Shingle-Type Skylight in Foreground and Bowed Ridge Saw-Tooth in Background—After Repairing. Below—Using Carbide Torch-Type Soldering Iron

This article discusses the problem of skylight maintenance at the Pennsylvania's station in New York, with approximately 60,000 sq. ft. of roof glass; it also describes the extensive repairs made recently to the skylights, which promise to correct permanently a bad leakage condition. Special features of interest in the work include several changes in the design of the skylights, and the extensive use made of Monel metal, which, in other sections of the roof, had demonstrated its durability as a roofing material under unfavorable conditions.

THE ROOF over the Pennsylvania's passenger station at New York, one of the largest and most unusual railway roofs in the country, involving extensive areas of skylights, tile and sheets of non-ferrous metal, has undergone major repairs which have brought to light a number of features of interest, aside from such interest as there is in the extent and character of the repairs made. Some of these things include the large problem involved in maintaining a roof of this size subject to a wide range of weather conditions and temperature stresses; the difficulty of keeping such a roof watertight, and of locating leaks when they occur; and the serious effect over the years of the abrasive action of minute particles of dust and grit in the air.

Another interesting fact made evident by the work is the large amount of Monel metal used in making the repairs to the skylights, involving the use of approximately 60,000 lb. of this material in sheet form, pressed into the various shapes desired. Based upon the present condition of large areas of Monel metal installed in the existing roof when the station was built in 1909, it is expected that the recent repairs involving the use of this material will be of a practically permanent nature.

Large Roof Areas

The Pennsylvania station at New York has a ground floor area of approximately 7.79 acres, extending approximately 790 ft. between Seventh and Eighth avenues on the east and west, and approximately 430 ft., between Thirty-first street and Thirty-third street on the south and north. Depending upon the structural design of the various sections of the building, the roof is of three general types of construction—flat, with a flat-tile surface; hipped and pitched of the batten-type, surfaced with Monel metal sheets; and skylight construction of various types. Possibly the most interesting and unusual part of the roof is the skylight areas, which include nearly every known variety of skylight construction, such as hipped, ridge, flat, barrel-roof, and sawtooth with bowed ridges, as well as circular and elliptical, all of the puttyless type, constructed with flat glass.

The main body of the station, including the large loading concourse at the west end, the large main concourse through the center, and the arcade and flanking areas at the east end, is enclosed by a continuous four-story office area from 40 to 50 ft. wide, which has a flat roof, involving approximately 150,000 sq. ft. of tile surface. The loading concourse, with a floor area of approximately 59,375 sq. ft., is covered by a steel frame,

nt Problem

The Repair Gangs Worked Over Small Areas at a Time. Below—Exterior and Interior Views of Extensive Skylight Area Over Loading Concourse

multiple-arch roof of unusual design, consisting almost entirely of skylights of the sawtooth type with curved or bowed ridges.

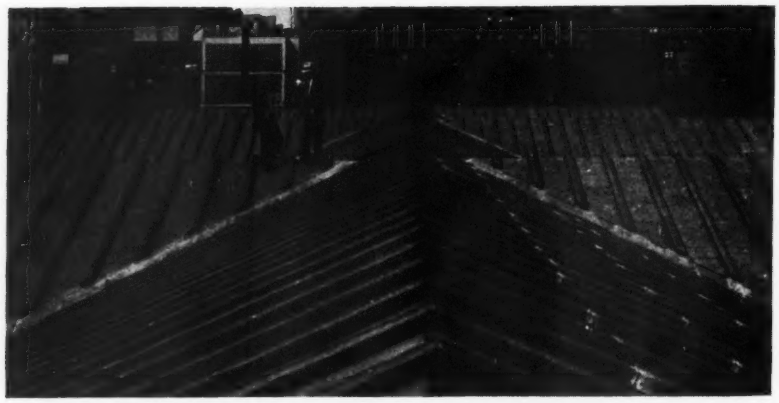
The roof over the main general concourse occupying the center portion of the station rises to a considerable height above the adjacent roof areas and is of the pitched type, with a batten-type deck covered throughout with Monel metal sheets. The section of the roof over the arcade connecting Seventh avenue with the main concourse is of similar construction, while the roof areas within the large train-wells on both sides of the arcade section are practically all of glass with the multiple-unit type of skylights placed in shingle fashion.

Many Problems

The most important problems encountered in maintaining the roof have been those arising from expansion and contraction and from abrasion of the softer metal parts by wind action. Corrosion of the non-ferrous roofing materials appears to have been negligible, except possibly within the parts of the skylight framework where the presence of accumulated moist dirt and soot over a long period of years has had an obvious deteriorating effect, possibly largely chemical in nature.

The problems of expansion and contraction, and of abrasion, have been the principal factors to contend with, and the primary reason for the recent large-scale repairs. The problem of expansion and contraction has extended to all sections of the roof—the tiled areas, where bulging occurred, with rupturing of the waterproofing beneath and consequent leakage into the building; the sheet-metal-covered areas, where expansion and contraction stresses pulled many soldered joints apart; and the skylight areas, where, in spite of presumably adequate expansion allowance in the skylight design, glass breakage was quite frequent.

The factor of abrasion from the action of dust and grit particles in the air is not often considered in roof construction, but with the softer non-ferrous sheet metal material employed in the skylight construction on this station, this appears to be the outstanding factor which made renewal necessary. All over the skylight areas, pieces of the sheet metal were actually worn so thin that they broke through in seams, and in some instances, in ragged holes. This was



The Monel Metal Sheet Roof Required No Repair Other Than the Resoldering of Joints

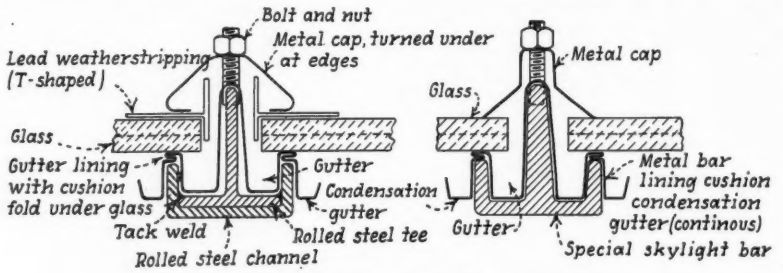
particularly true along ridges of the material where the breaks were unquestionably augmented by physical motion of the material due to expansion and contraction in the roof, and to some loss of resilience in the material itself owing to its long exposure.

As a result of these various factors, the different parts of the station roof have required various degrees of attention and maintenance during its 27 years of service life. The single exception in this regard was those areas covered with Monel metal, where maintenance has been negligible except for the resoldering of some of the joints between sheets. As a matter of fact, in the present extensive repairs to the roof as a whole, the only work on those sections covered with Monel metal was considerable resoldering of the character named, the sheets themselves still being in first class condition.

Skylights

The most extensive work in connection with the recent repairs to the roof has been in the skylight areas, comprising approximately 60,000 sq. ft. of glass, where every section of glass was removed and the various parts of the framework were cleaned, painted where necessary, or renewed. Regardless of the particular shape or type of skylight, all had flat rough wire glass ⅜ in. thick, and the same general type of frame for holding the glass in place. This included essentially gutter-type steel supporting bars or muntins, which carry the glass, and continuous metal cap strips which cover the openings between glass sections and are secured in place by brass bolts and nuts anchored at intervals along the bars. As weatherstripping for the metal caps, thin ribbons of metallic lead, ½ in. wide, were placed longitudinally between the edges of the caps and the glass.

The gutter feature of the bars provides for carrying off any rain water which, in spite of the lead weatherstripping, might be driven between the glass and the sheet metal caps and work its way to the under side of the glass. Falling into the gutters of the bars, this water is normally carried down through the bars and discharged through openings in the bronze shoes which hold the bars to the roof purlins against lateral motion. To protect the steel bars against corrosion, they were lined with a non-ferrous material in sheet form. This was carried outside the side limits of the bar and suitably bent upward to form collecting gutters for any condensation that might form on the underside of the glass and move laterally toward the edges.



Sketches of the New and Old Skylight Assemblies

Difficulties

In spite of the fact that the gutter linings and metal caps were of a non-ferrous material, it was noted as early as four or five years ago that they were being seriously affected by abrasion. Not only that, but it was noted that lifting or curling of the edges of the caps had allowed much of the lead weatherstripping to slip out of place. This permitted excessive water to be driven into the bar gutters; soot and dirt also accumulated in and fouled them, particularly at their lower end, in many cases completely blocking drainage. When this condition developed, subsequent water driven into the gutters overflowed on the underside of the glass and dropped to the floor areas beneath.

A second serious difficulty occasioned by the fouling of the gutters with dirt and soot was that this material held moisture and in this state caused some corrosive action on the gutter linings. More important, the moisture got around or through the weakened linings and attacked the steel supporting bars, many of which were severely corroded. As a result, the problem of repair of the skylight areas was not alone that of replacing all of the skylight caps and many of the gutter linings with new material, but also the renewal of a large number of the supporting bars. In most cases, however, the corrosion of the bars had not gone far enough to require their renewal, and they were merely cleaned of any rust or scale and afterwards painted with a metallic compound.

Material Too Light

In view of the severe weathering and abrasion of the sheet metal employed in the skylight construction, the question has been raised whether the original non-ferrous linings and caps, of 16-oz. material, were sufficiently heavy and stiff. At any rate, it is felt that if a heavier material had been used, the problem of replacement because of weathering, abrasion and curling edges would have been delayed for a number of years.

Finding it necessary to renew all of the caps and many of the gutters, the railroad sought not alone a material more resistant to weathering and abrasion than that which had been used formerly, but also one with a higher degree of resilience, particularly for the caps, which would insure a constant uniform pressure on the glass. It also sought an improvement in the design of lead weatherstripping employed between the caps and the glass.

Largely because of its favorable experience with the Monel metal sheets on the adjacent areas of roof under the same physical conditions, consideration was naturally given to

the use of this material for the new caps, which was ultimately decided upon. For the gutter replacements, not subject to abrasion, the same material was used as formerly, but of a heavier weight, 24 oz, to the square foot instead of 16 oz.

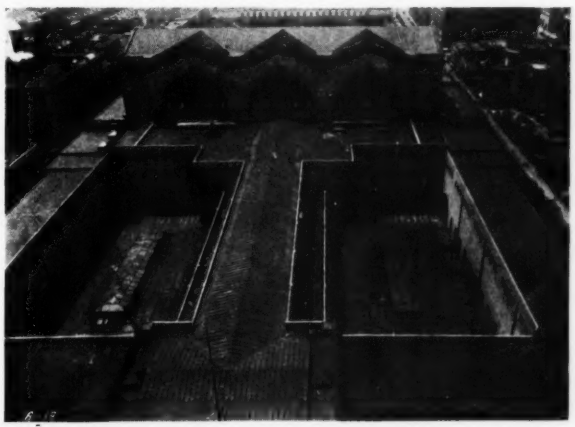
Change in Cap Design

One fundamental change was made in the cap design, which involved bending its lower edges under approximately ⅜ in., so that instead of a line bearing on the weatherstripping, the caps have a stiffer flat surface bearing along both edges. Through this design it is felt that uniform pressure will be maintained on the glass, without any tendency for the cap edges to curl, and also that the wider bearing will more effectively prevent the entrance of water and dirt, without in any way retarding freedom of the glass to expand and contract with temperature changes. Both the new caps and the new gutter linings were cut and shaped in the plant of the contractor making the repairs to the roof.

The new lead weatherstripping adopted is entirely different from the old flat lead strips employed, and is intended not alone to exclude water and dirt from the inner parts of the skylight framework, but also, in the event that water and dirt do get under the caps, to drain them off as directly and quickly as possible, and keep as much as possible out of the gutters. The new weatherstripping is a T-shaped extruded section, the longer leg of which is placed flat on the top surface of the glass directly beneath the bearing of the cap. In this position, one leg of the top of the T section extends upward under the cap, forming, in itself, a gutter for carrying off any water or dirt that might be driven under the edges of the caps, and practically insuring that little or no water or dirt will get into and foul the normal drainage gutters, as occurred with the old design.

New Eaves Closures

One other part of the skylight construction which was replaced throughout with Monel metal was the eaves closures along the lower edge of each tier of glass. The non-ferrous metal that had been used for these closures in the original construction was seriously affected by both abrasion and the tendency for the edges of the material to curl, the same as in the caps. In other words, without uniform bearing on the underside of the glass in the upper tier, and on the top face of the glass in the tier immediately below, there was little resistance to the entrance of both dirt and water, particularly in driving storms. Through the use of the stiffer and more resilient Monel metal for these closures, even though of the same shape as the old closures, a firmer and more uniform bearing is insured against the glass in both tiers. To make water-tightness of the lower bearing of the closure piece still more positive, a flat lead strip was introduced between the lower bearing edge of the closure piece and the surface of the glass. To insure that this weatherstripping would not slip out of place, it was soldered to the lower bearing edge of the closure pieces, and was then cemented to the top of the glass as installed. Through this construction it is believed that it will be practically impossible over a long period of years for any water to be driven into the building at the eaves.



View Over East Half of the Station, showing Metal-Covered and Other Types of Roofs

Repair Operations

The first operation in making the repairs to the skylights was to remove the cap strips, and then, after lifting out the glass, to remove the old gutter linings and eaves closures. Throughout this stage of the work, the clogged condition of most of the gutters and the softened curled edges of the closure pieces made it clearly evident why so much difficulty had been experienced with leakage.

With the glass and gutter linings removed, those supporting bars that were badly corroded were replaced, and the remainder of the bars were cleaned and painted. The new bars installed were similar in shape to those removed, but unlike the old bars which were rolled as one-piece sections, the new bars were formed of a T-section inverted and tack-welded within a light channel section. This arrangement utilized stock shapes readily available and accomplished the same purpose as the original bars, without the largely increased cost that would have been involved in obtaining new bars of the old design. The new special bars, of course, as would have been the case with new bars of the old design, had to be fitted with brass cap-holding bolts, expanded into notches provided for the purpose, but this presented no special problem.

Approximately 16,000 sq. ft. of Tile Roof Required Repair

Wherever possible, the old gutter linings were cleaned, reshaped and replaced, but where worn thin or cracked, they were replaced with new linings. While this work was going on, the new Monel metal eaves closures were installed, and men working below on flat areas of the roof cleaned the glass with a special cleaning solution.

As the glass was reset in the skylight frames, the T-shaped lead weatherstripping was cemented in position with a non-hardening cement, and then the new metal caps were placed and secured by means of new Monel metal nuts applied to the cap bolts. The last operation in this specific phase of the repair work was to press the exposed edge of the lead weatherstripping firmly and smoothly against the top face of the glass, using a flat tool and making one continuous pass from the bottom of the skylight section to the top, and then to scrape and wipe off any surplus cement pressed out from beneath the weatherstripping.

Leakage Stopped

With the completion of the skylight repairs, there was an end of all leakage. As a matter of fact, it is believed that through the redesign of certain features of the skylight construction, the skylights are now in a more serviceable condition than they were when first installed.

In all of the skylight repairs, the work was confined to a relatively small area at a time. However, with a well-organized force and the receipt of all new materials cut and shaped, ready for application, the work moved rapidly, even though it had to be carried out most carefully. In only a few locations could scaffolding be erected beneath the glass to assist in carrying out the work. Therefore, practically all of the work had to be done from above, which in many locations was a difficult and awkward procedure.

Protection Provided

As protection to those on the floor areas beneath the sections of skylight being repaired, both from dirt and possible falling tools or glass, heavy canvas with wire mesh laid on its upper side, was suspended directly beneath all roof openings. Placing this was very difficult in most cases, and could only be done by arranging the canvas and wire mesh on the floor, and then drawing them up into the position desired beneath the roof by means of ropes let down through openings where individual sections of skylight glass had been removed. As a further precaution against injury to persons moving about beneath the work, the section of the floor area directly under the work was roped off against use by passengers or employees during the conduct of the work.

Sheet Metal Roof

Repairs to those areas of the station roof covered originally with Monel metal sheets were, as before stated, confined entirely to the resoldering of joints between the sheets. Here, double-lap soldered joints had pulled apart, almost regardless of their location, in valleys and gutters, along flashings, joining the sheets longitudinally along the roof battens, and horizontally over the body of the roof. Altogether approximately 5,000 lin. ft. of joints were repaired.

Apparently, the primary cause of the defective joints was the expansion and contraction in the roof structure and in the roofing material itself, adequate provision for which had not been made. Furthermore, it was found that in the original construction the joints had not been tinned prior to assembly and soldering, so that the solder had little holding power and added little to the strength of the joint.

In all of the repair work, joints requiring attention were opened up to expose both edges of the sheets, and were then cleaned and tinned before reassembly and soldering. Through the tinning, the solder, when applied, was drawn inward throughout the limits of the lapped metal, forming a joint with strength comparable to the metal itself.

All tinning and soldering was done using killed muriatic acid as a flux, and all solder employed was of a composition of 60 per cent tin and 40 per cent lead. For the most part, carbide-flame soldering irons were used in the work for cleaning joints, tinning and soldering. This type of iron, in which a carbide flame plays continuously on the iron itself to maintain it at the proper temperature, materially facilitated and speeded up the work, particularly in view of the working conditions on the roof, which would have made the charcoal stove or separate blow torch arrangements slow and ineffective.

Repairs to the flat tile sections of the station roof, which required the removal and replacement of approximately 16,000 sq. ft. of tile, were necessitated largely because of expansion. Here, 1-in. flat tile had been laid in a bed of mortar over a course of five-ply felt and pitch waterproofing, without sufficient expansion joints. As a result, many areas of the roof deck bulged, admitting water, which, in time, leaked through the waterproofing beneath.

Repairing Tile Roofs

In repairing the damaged tile sections of roof, all of the tile in these areas was removed, and, after preparing the old waterproofing, a new two-ply course of 11-oz. fabric was laid in hot asphalt. On top of this a 1:3 cement mortar cushion, 2 in. thick, was applied to carry the tile, which was laid with ¼-in. cement-grouted joints.

To avoid difficulty with expansion in the future, adequate expansion joints were provided in all of the new work. These were filled with an expansion joint compound and were arranged along both sides of every ridge in the generally flat roof, where they are least likely to cause trouble from leakage.

The repairs to the station roof were planned and carried out under the direction of R. R. Nace, chief engineer maintenance of way of the New York zone, and R. H. Crew, division engineer, New York division, and under the immediate supervision of B. F. Stidfole, Jr., master carpenter, and George Chew, building foreman. All of the work was done under contract by Jacob Ringle & Son, Inc., Jersey City, N. J.

On the Union Pacific East of Cheyenne, Wyo.

Concrete and Steel in Trestle Construction

An outline of the reasons for substituting these materials for wood in the smaller railway structures

By R. P. HART
Assistant Bridge Engineer
Missouri Pacific, St. Louis, Mo.

Setting a Precast Slab on the Bents of a Three-Pile Trestle

FOR MANY years the railroads continued to build and rebuild trestle bridges along the same general lines that were first adopted and used. If a pile decayed at the ground line or under the cap it was replaced with a post, leaving the bent in a weakened condition. When it became necessary to redrive the bents it was necessary to do considerable re-arranging of the timbers in the old bridge in order to drive the new piles to specified spacing. This was not only expensive but often resulted in annoying delays to traffic.

As engine loads became heavier and train speeds were increased it became necessary to increase the size or number of stringers, and also to move the bents closer together to reduce span lengths. Then difficulty was encountered with crushing caps, due to heavy load concentrations on the bents. Such difficulties were discouraging and led to a search for more permanent types of construction, but even the first concrete trestles were designed with five or six piles to the bent, with attending difficulties and high costs of driving them under traffic. Some further change was necessary in order to develop a more permanent type of structure that could be built with less interference to traffic and more nearly compete with timber trestle construction in cost.

The Three-Pile Concrete Bent

It was to satisfy these requirements that the Missouri Pacific, in 1932, developed and introduced concrete pile bents composed of three 24-in. octagonal piles with various types of accompanying superstructure. The three-pile bent provides for the driving of one pile between old trestle chords and one outside of each chord, so that driving entails very little disturbance of the old bridge. This results in a lower cost of new construction, as well as less maintenance on the old structure and reduces interference with traffic during the construction period. The caps are cast in place at low cost by using sectional forms supported upon steel angles clamped to the piles and by placing the concrete with a portable mixing plant. The piles as well as the slabs are precast at a centrally located storage yard where high grade concrete aggregate and ready mixed concrete are available. Since late in 1932 the Missouri Pacific has driven nearly 5,000 of these large piles, and about 5 miles of ordinary timber trestles

*Abstracted from a paper presented before the convention of the American Railway Bridge and Building Association.

have been replaced, utilizing large piles in some manner. They have been used in trestle bents, for foundations and as precast column sections for high bents.

This pile is not claimed to be the last word in design and further improvements may be expected. Developments along this line may have been retarded because of the special equipment required to drive large piles. Although the first cost of this driving equipment seems rather high it actually amounts to only a small fraction of the cost of the piles in place, when distributed over several thousand lineal feet. Much of the equipment may also be used for other purposes if not required continuously for bridge construction.

Special Problems

While the 24-in. concrete pile is advocated for more or less general use under ordinary conditions, there are situations to which it is not suited or to which it can be adapted only in modified form. When driven to rock foundation through shallow or soft overburden, the tapered points should be cut back to provide a larger tip, so that allowable unit bearing stresses will not be exceeded at the point of the pile bearing on rock. If the overburden above rock is quite shallow it may be necessary to set the piles in place and cast a footing around their points or replace them entirely with a properly designed concrete frame bent. There are other situations where it is necessary or desirable to construct collars around the piles at ground level, or to use double bents, in order to provide a structure with sufficient rigidity and meet specification requirements.

It is apparent that the three pile bents are particularly adaptable to many situations encountered at ordinary trestle bridges. They can be used with concrete slab spans 15 to 19 ft. in length and with steel beam spans 20 to 27 ft. long so that new bents may be located to avoid old bents and pile stubs. Where conditions warrant, there is little, if any, objection to varying the length of adjacent spans in the same bridge in order to avoid interference with previous construction. Where the stream crossing is at an angle, the bents can readily be constructed on a skew to fit the angle of crossing, thus providing a more suitable waterway without loss in rigidity of the structure.

Should the height of the structure or stream conditions demand the use of longer spans the requirements can usually be met with wide-flange rolled beams. These beams lend themselves to simple and inexpensive fabrication and can, of course, be cut to form square or skewed spans of various lengths to suit the needs of the purchaser. One problem arising with the use of such beams is the liberal tolerance allowed at the rolling mills. The depths of beams varies to such an extent as to require the use of sole plates of variable thickness in order to maintain a uniform depth from base of rail to top of bearings. Unless specifications definitely prohibit, the beams may also be furnished with reverse camber and twisted flanges.

With the present day tendency toward higher speeds of trains it is necessary to see that spans to be fitted with open decks are so fabricated as to provide a uniform track surface. Some structural shops have not been as careful as they should be in fabricating camber into plate girder spans. In multiple span bridges where longer spans are required, excess camber may result in unsatisfactory surface of the track over those bridges. It is suggested, therefore, that both the minimum and the maximum camber permissible be specified. On ballasted deck spans camber may, of course, be neglected.

Discussion of steel spans leads us to think of the possibilities of using steel piles. To date their use has been more or less limited, but sections are now being rolled that are more suitable for three-pile bent construction to accommodate railroad loading and it is probable that we may see them used more generally in the future. They are suitable for use where the ground above rock or a hard shale foundation is extremely hard or consists of compacted gravel or soft shale thus making it difficult or impractical to drive concrete or wood piles which must displace a considerable volume of the soil. In some of these cases it is essential to drive the piles through the soil or gravel to the rock foundation because of the hazard of subsequent erosion of the stream bed. It is not difficult to accomplish this with steel piles because their cross-sectional area is small, and when driven with a suitable hammer they will cut their way through even comparatively hard shale. Some steel piles have been driven where they were depended upon to carry their loads through surface friction only, but they seem best adapted to a situation where they can be driven to rock through considerable overburden and carry the necessary load as a column, with the points bearing on the rock and the body of the piles receiving some lateral support from the surrounding soil. Deterioration of piles by rust, particularly at the ground line, should be carefully guarded against by jackets or collars of concrete, or by providing some suitable surface coating.

Example of a Long Trestle With Steel Beam Spans on Concrete Pile Bents

From the foregoing it might be assumed that timber trestles are no longer considered suitable for ordinary bridge reconstruction. Nevertheless the timber trestle has its place and, if proper attention is given to the details of its construction, we are sure to have it with us for many years to come. Fastenings should be improved to provide more stiffness in the structure and certain structural weaknesses should be remedied. To make the timber trestles comparable with concrete and steel bridges in load-carrying capacity will increase the cost considerably, but this must be done if it is to survive. Heavy loading and high speed will demand it.

How Many Fire Extinguishers?

By W. A. Radspinner
Superintendent Fire Protection, Chesapeake & Ohio, Richmond, Va.

Adequate provision for fire protection at isolated stations sometimes affords a problem difficult of solution because of the wide variety of conditions which surround these facilities. In this article Mr. Radspinner discusses the fundamental features which must be given consideration in deciding on the protection to be provided.

FIRST-AID fire protection is provided primarily to put out fires. However, the presence of sufficient extinguishers, of the correct type and in the right location, has a very direct bearing on the amount of insurance premium one must pay on a building.

As a guide for such protection and equipment the National Board of Fire Underwriters has published in convenient form a small pamphlet entitled Regulations of the National Board of Fire Underwriters for the Installation, Maintenance and Use of First-Aid Fire Extinguishers. This pamphlet covers all types of buildings and all kinds of risks including oil, electrical and various kinds of material. For a complete study of first-aid fire protection, this pamphlet should be consulted.

The proper protection for a railway station depends on several conditions:

1. Whether it is of frame or fireproof construction.
2. Whether it is one or several stories in height.
3. Whether it is open 24 hours a day.
4. Whether an employee is on duty 24 hours a day.
5. Whether it has electrical and signal, including remote control, apparatus inside.
6. Whether it is in a city with city fire-department protection.
7. If it is at an outlying point, how close it is to the agent or any employee having access to it.
8. Whether it is close to a public highway and used by trespassers, autoists and truck drivers.
9. Whether it is used as a joint freight and passenger station.
10. Whether the maintenance forces keep inflammable material in it.

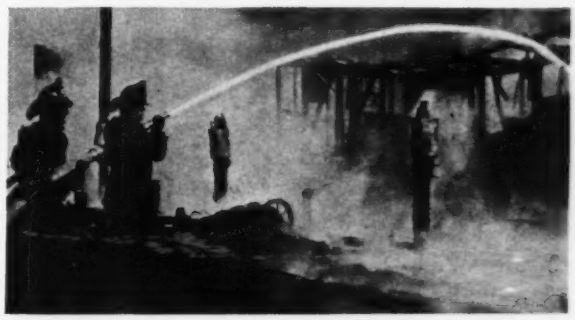
One does not want to provide expensive equipment, which will be locked up in a building for 16 hours a day, or depend on water buckets to put out a fire on a second story roof. Likewise, it is not practicable to use water to put out fire in signal or lighting equipment or in oil storage.

It is well to remember that a small station may house remote control apparatus serving long runs of double track. The loss of such a building and apparatus may make it necessary to erect two or more telegraph stations and pay standard wages to telegraph operators on three tricks. It is important, therefore, that each station be provided with the protection needed for the occupancy and this is best accomplished by having the fire-protection inspector make the proper recommendations as a part of his duties.

A station building may house electrical apparatus for lighting and remote control, as well as for signal systems. The correct type of protection for such a risk is at least one 1½ qt. carbon-tetrachloride fire extinguisher which should be located near the electrical equipment and in plain view. This is a small brass pump-type extinguisher which contains a liquid that smothers a fire and will not conduct electricity, so that it can be discharged directly into an electrical fire without damaging the equipment. This same kind of an extinguisher can be used to put out small oil fires and fires in waste baskets, packages, etc.

While this type of extinguisher does not have to be refilled until used, it should always be kept filled and should be tried about once every year to see that it is in good operating condition. If a cheap liquid is used to refill this kind of an extinguisher it will corrode the stem and valves or stop it up. For this reason, when the original charge has been used, it should be re-filled with a liquid furnished by the manufacturer of the extinguisher or one that bears the approval of the Underwriters' Laboratories.

One form of protection used most commonly for small stations is the water barrel and fire bucket. The contents of these barrels can be treated with salt or calcium chloride to prevent freezing. A 50-gal. barrel or drum with two pails or buckets forms a standard unit on the Chesapeake & Ohio. These buckets can be used only for fires where water can be poured on the fire. Water cannot be thrown effectively from them for more than 10 ft. For that reason, they are practically useless for roof or attic fires and the trouble is now that trespassers such as truck drivers, etc., steal them. The barrels should be located conspicuously where they will always be readily accessible and so distributed as to be within 50 ft. in the event of a fire. Buckets should be hung on hangers, or set on brackets or shelves, so that their upper rims will not be higher than 5 ft. or less than 2 ft. from the



The Provision of an Adequate Number of Fire Extinguishers Is a Factor in Preventing Destructive Fires

*This discussion was submitted for publication in the What's the Answer department in the September issue as an answer to the question as to how many fire extinguishers should be provided for small stations. Owing to its scope it was withheld for presentation here as an independent article. For further discussion of the subject, see page 549 of the September issue.

floor. On the Chesapeake & Ohio they are mounted on the lid covering the fire barrel.

Where someone is on duty at all times and it may become necessary to reach a second story or roof for fires in birds' nests or flue fires, the use of a 2½-gal. soda-and-acid fire extinguisher is recommended. If the building is not heated all of the time, the extinguisher must be kept in an electrically heated frost-proof box to prevent freezing.

Such extinguishers should be mounted near the door where they can be seen and reached easily by anyone entering the station. These extinguishers must be discharged and recharged once every year. It is a good plan to have someone discharge it who might be called on to use it in the event of a fire, because it is remarkable how many people who see such extinguishers every day, do not know how to discharge one without wasting most of the contents.

If gasoline, grease or oil is stored in any quantity in the building it should be protected by a foam-type 2½-gal. capacity extinguisher. This extinguisher must be protected from freezing and must be discharged and recharged once a year. It should be located near the entrance and in plain view.

The most satisfactory extinguisher for all purposes, except electrical and oil fires, appears to be the pump-type extinguisher. Such extinguishers can be purchased very reasonably when made of galvanized iron. They should have good brass pumps and be coated inside to prevent rusting. One manufacturer will, for a nominal sum, convert old soda-and-acid or foam-type extinguishers to the pump type, which includes a copper tank that does not rust out. These extinguishers come in 2½, 3 and 5 gal. sizes and can easily be prevented from freezing by the use of calcium chloride. They do not have to be recharged except after use and can be filled and used as often as needed in case of use at a fire. They shoot a stream 30 to 40 ft. high which is a feature often needed when fighting roof fires.

Following is a formula to use to prevent freezing, from which the necessary solution can be prepared by the agent or section forces. This will save the time of a supervisor in going over the road with recharges once each year to fill the soda-and-acid type of extinguishers:

To prepare a 2½-gal. extinguisher against freezing at 10 deg. below zero one should use 7½ lb. of calcium chloride, first filling the extinguisher with 2 gal. of warm water; then add the calcium chloride and dissolve thoroughly. Finally, add one tablespoon full of lime and dissolve.

I do not enthuse particularly about riser pipes with hose attached for freight houses, especially where there is a city fire department. Water barrels or other first aid equipment are good enough for small fires or to hold a fire in check until the fire department arrives. If the fire occurs after the men have stopped work everything is locked up. I would, therefore, rather have a fire hydrant outside, with hose in a house or on a reel, than a dozen riser pipes inside where they cannot be reached. In other words, the best plan is one that works. As a result of fires there are often delays to operation that cause greater loss than the loss to the building, all of which justify the existence and maintenance of a fire protection organization and of well organized local means for fire protection on every railroad.

"It's Up to You"

THAT "Safety First" is not a meaningless slogan to some of the men in the maintenance of way department, but is a matter of real concern to them is indicated by a plan which has been followed for some time by W. P. Hesterly, a section foreman on the Southern Pacific at Lufkin, Tex., and his gang. Because of the fidelity with which safety-first practices are observed, this gang has now worked 200,000 man-hours or more than 10 years without a reportable injury.

This gang, consisting of the foreman and 6 men, is assigned to the section at Lufkin, which includes a yard containing 50 switches and 6 miles of main line. Lufkin being the district headquarters, the scope of the work of the gang goes considerably beyond track maintenance proper, since the men are often called on to lend assistance to the water service, bridge and building, telegraph and telephone, and mechanical departments. In addition, it accompanies the supply train on its periodic trips over the 230-mile district between Houston, Tex., and Shreveport, La., to load scrap rail and other materials. It is obvious, therefore, that this gang is exposed to a greater variety of hazards than ordinarily falls to the lot of a gang that is engaged solely on track maintenance on a limited territory where it is familiar with every condition.

Various expedients, such as discussions of safe practices and of the spe-

Reproduction of the Placard Posted for the Gang at Lufkin

IT'S UP TO YOU

DON'T STRADDLE THE BAR WHEN LINING TRACK

DON'T USE A SPIKE MAUL TO STRIKE A CHISEL OR OTHER TOOLS

DON'T SMOKE IN THE TOOL HOUSE OR ON A MOTOR CAR

DON'T STRIKE THE HEEL OF THE CLAW BAR TO FORCE IT UNDER A SPIKE HEAD

DON'T PULL ON A TRACK WRENCH WHILE STANDING ASTRIDE A RAIL

DON'T WAIT UNTIL A TRAIN IS NEARLY ON YOU - GET OFF THE TRACK WHILE ALTOGETHER - YOU MAY STUMBLE AND THEN BE REMOVED IN PIECES

DON'T LOOK AT A CHISEL WHILE A BLOW IS BEING STRUCK, THE HAMMER MAN EXCEPTED

DON'T LEAVE THE BAR IN A JACK AFTER A LIFT HAS BEEN MADE

DON'T LEAVE SHOVELS OR OTHER SHARP EDGE TOOLS LAYING WITH THEIR BLADE OR EDGE UP

DON'T SHARPEN ANY TOOL WITH THE BLADE OR POINT TOWARDS YOU

DON'T FAIL TO REPORT ALL INJURIES, NO MATTER HOW SMALL

DON'T USE DEFECTIVE TOOLS OF ANY KIND

DON'T WALK ON OR BETWEEN TRACKS WHEN OFF DUTY; IT IS DANGEROUS

---REMEMBER---

THE STORES DEPARTMENT FURNISHES EVERYTHING NEEDED TO WORK WITH EXCEPT EYES, ARMS, HANDS, FEET AND LEGS.

BE CAREFUL

cial safety rules which are issued from time to time, talks on safety and other educational methods had been employed in teaching safe practices. One day Mr. Hesterly posted a large placard bearing the caption, It's Up to You, a copy of which is shown, in a prominent place in his tool house. This placard contained a special list of "Don'ts," which had not been included specifically in the safety rules which had been issued.

These "Don'ts" made such an appeal to the men in the gang that they immediately made an agreement among themselves, and insisted that the foreman become a party to it, to assess a fine of one penny against every violation of any of the prohibitions, the penny to go to the man who caught the other fellow breaking any of the rules thus laid down. For the first few days pennies changed hands rather freely, but the cumulative effect of keeping these items uppermost in the minds of the men soon became apparent as the exchange of pennies slowed down. It is with considerable satisfaction that Mr. Hesterly reports that no occasion has been found to assess a fine for months.

In discussing this matter, Mr. Hesterly disclosed that on the 230-mile district between Houston and Shreveport, upon which there are 29 sections, there has not been a reportable accident in the maintenance of way department for more than four years. He attributes this enviable record largely to the interest in safety matters shown by the roadmaster, H. G. Kornegay, who keeps the subject constantly before his organization by means of circulars, safety meetings and personal talks with his men.

Norfolk & Western Track Awards

CONTINUING a practice of more than 45 years standing, the Norfolk & Western again carried out an annual track inspection in 1936, and, as a result, awarded cash prizes totaling $2,090 to 83 foremen for general excellence in the condition of their territories. According to the ratings established, the condition of the tracks on the road as a whole in 1936 was equal to the high standard established in 1935, when, on the basis of the results of the annual inspection, the tracks were found in a more favorable condition than at any time since annual inspections were inaugurated.

As in past years, the inspection was made by separate committees on line and surface, switches and frogs, ditches and roadbed, right-of-way, and on station grounds and road crossings, and first, second, third and fourth prizes of $40, $30, $20 and $10, respectively, were awarded, with a few minor exceptions, to foremen on each roadmaster's district. On the basis of 10 as perfect, the system rating in 1936 was established at 9.27, the same as that in 1935, one hundredth higher than in 1934, and two hundredths higher than in 1933. On the same basis of 10 as perfect, the highest division rating, 9.39, was given to the Roanoke terminal, while the second highest rating of 9.35 went to the Scioto division.

The highest rating ever given to a roadmaster's district, 9.41, was awarded to the Vera-Cincinnati district of the Scioto division, which showed an improvement of five hundredths over the rating which it received in 1935. The Roanoke-Walton district of the Radford division and the Clinch Valley line of the Pocahontas division tied for second district honors, each with a rating of 9.40.

A Track Inspection on the Norfolk & Western in 1892

Section foremen A. C. Davis, on the Pocahontas division, at Tazewell, Va., and Ernal McCann, on the Scioto division, at Sardinia, Ohio, both consistent winners in the annual track competition in recent years, tied for first section honors with the rating of 9.49. The other foremen who received the highest ratings on their respective divisions or terminals were A. Zimmerman, Norfolk terminal, with a rating of 9.44; C. W. Jamerson and S. H. Stanley, Norfolk division, each with a rating of 9.45; E. D. Ramsey, Shenandoah division, with a rating of 9.42; B. H. Tinsley, Roanoke terminal, with a rating of 9.42; and W. M. Catron, on the Radford division, with a rating of 9.46.

Curve Lubrication

(Continued from page 27)

and also from the greater life of ties that is realized where regaging is obviated and the interval between rail renewals is materially increased.

In curve territories where the life of the high rail is fairly long, and it is questionable whether rail and flange lubrication will be economical from a rail-saving standpoint only, the additional economies resulting from the reduction of flange friction on the high rail in curves will frequently warrant the installation of track lubricators. For example, the motive power and operating departments on a number of railroads have become interested in track lubrication because of the economies resulting from decreased flange wear on locomotive, tender and car wheels, the ability of locomotives to run around sharper curves more easily in yard tracks, decreased derailment hazards, higher train speeds with safety, increased tonnage ratings through lubricated territories where curvature governs such ratings, or decreased fuel consumption. A number of instances have been cited where helper service has been discontinued since curve territories were lubricated. Reports show that the increased life of locomotive wheels, due to reduction in flange wear often warrants rail and flange lubrication without even considering the saving in rail wear.

There are few definite figures available covering the economies resulting from increases in tonnage ratings that were brought about entirely by rail lubrication, but the indications are that increases in tonnage ratings of as much as 10 per cent may be realized from rail lubrication alone. Tests to determine increased tonnage ratings are in prospect, as well as tests of increased train speeds and decreased fuel consumption due to rail and flange lubrication.

There is no question but that the reduction of flange friction by lubrication greatly decreases the tendency of wheels to climb the outside rail, and that rail lubrication affords much smoother and safer operation of high speed trains around curves.

It has been demonstrated, however, that the great reduction in high rail derailments on certain carriers would warrant the cost of the rail and flange lubrication many times over. Thus, in border line cases, where rail lubrication may just about pay for itself, when compared to the saving due to increased life of high rail in curves, these additional advantages warrant the installation of lubricators.

What's the Answer?

When Joint Bars Are Reformed

When joint bars are reformed, should they be crowned at both the top and bottom, or at the top only? Why?

Not Economical

By E. L. BRAND
Division Engineer, St. Louis-San Francisco, Tulsa, Okla.

From a rather extended experience in building up rail ends and reconditioning rail joints, I feel assured of the economy of reforming joint bars to compensate for the wear between the top of the bar and the under side of the rail head. On the same basis, I fail to see the economy of crowning the bottom fishing surfaces. It has been my observation that when a joint bar has worn to the extent that it is necessary to build up or reform the bottom, it has reached the point where it is of little use in either supporting the rails or maintaining a satisfactory riding condition of the track. Furthermore, at this stage it is almost impossible to keep the bolts tight on the joint bars.

At Top Only

By G. M. MAGEE
Assistant Engineer, Kansas City Southern, Kansas City, Mo.

Primarily, the purpose of joint bars is to hold the abutting rail ends to the same elevation and, in addition, to connect them in such a way that the rails will act as a continuous girder in distributing the wheel loads over the supporting ties. Rail deflects downward, forming a depression curve under the wheel loads, thus developing what is termed a positive bending moment. Between the wheels, especially if they are spaced a considerable distance apart, the rail curves upward, forming a "hump," and develops a negative bending moment. The negative moment is much smaller than the positive moment, usually less than half. It is to be expected, therefore, that the wear on the joint bars will be most pronounced from the positive moment.

With positive bending moment, the wheels being at or near the joint, the rail ends tend to depress and form an angle with each other. The joint bars, if straight and tight fitting, tend to hold the running surfaces of the abutting rail ends in the same plane. Obviously, the rails will bear down on the top of the bars near the rail ends and upward on the base of the bars near the ends of the bars. Because the bars are not as stiff as the rail, the length of the bearing at the top of the bars near the rail ends is shorter than at the bottom of the bars at their ends, especially for six-hole bars. The total bearing pressure on the top of the bars, acting downward, is equal to that on the bottom of the bars, acting upward, but since the bearing area at the top is much smaller than that at the bottom, the intensity of the pressure at the top is much greater. It is also intensified by the impact from the car wheels as they pass over the joint gap, particularly if the rail ends are battered. The result of these factors is that there is much more wear on the top of the bars and on the fishing surfaces under the rail head close to the joint than there is on the bottom of the bars near the ends and on the fishing surfaces at those places.

With negative bending moment, when the rail is humped at the joint between two car wheels, the rails bear upward on the bottom of the bars near the rail ends and downward on the top of the bars near their ends. Owing to the lack of impact, however, and the smaller magnitude of the negative moments, the resultant wear is seldom appreciable.

These facts make it apparent that the least wear occurs at or near the quarter points of the bars, where it is caused principally by the wave action of the rail and the movement of

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in March

1. *What causes soft spots in the roadbed? How can they be prevented?*
2. *What is a paint drier? How does it affect paint? Should it be used with a bridge paint? If not, why? If so, are there any precautions to be observed?*
3. *Should adzes be sharpened on a grindstone or on a tool grinder? Why?*
4. *What stock of materials should a building gang carry on its supply cars?*
5. *How does one determine the distance between frog points when installing a crossover between straight tracks? On a curve? When the frogs are not of the same number?*
6. *What causes noises in steam coils and radiators? How can they be prevented?*
7. *Is a hewed tie or a sawed tie better? Why? Does the kind of wood or the treatment make any difference?*
8. *Where the pins of a pin-connected bridge become worn, what methods can be employed to take up the slack or otherwise overcome the condition?*

the rail in the bars during changes in temperature. It is also apparent that the wear at the ends of the bars is relatively small, and that the greatest wear is on the under side of the rail head near the joint and on the top of the bars where they contact this part of the rail.

For these reasons, when joint bars are reformed, to obtain a proper fit it is necessary that they be crowned only at the top near the center and that the remaining portions of the bars be brought to the original section, or uniformly higher to the extent that the rail wear justifies. The amount of crown to be applied should be determined by the amount of rail wear. Usually this will not exceed 1/32 in., although in extreme cases as much as 1/16 in. may be necessary.

Do Not Use on New Rail

By Assistant Engineer Maintenance of Way

Reformed bars were first offered to the railways without any crown, for use with new or sawed rail. The idea of crowning the bars and not sawing the rails followed immediately, since it was becoming the practice to compensate for rail batter by welding. The need was at once recognized for full corrective measures, and of providing tight fitting joint fastenings to raise and hold the rail before welding. Later experience has shown that by putting the bars through the routine of heating, reforming bolt holes and quenching, it is possible to furnish bars which will meet specifications as rigid as those under which new bars are accepted.

Bars were first offered with a triangular crown, that is, with an apex 1/32 or 3/64 in. high at the center of the bar, the top sloping to the original height at the ends. As it became generally recognized that most of the wear occurs between the inner bolt holes, a shorter crown, shaped to meet the average requirements, was devised. Later, a bar with a circular crown was offered. Bars of the head-free type assure a more precise fit, because they make their contact in the fillet where wear does not occur with bars of the usual fishing-fit design. On the other hand, the contact area is small and wear may accumulate more rapidly than on bars of more common design. So far as our experience goes, however, the head-free type of reforming seems to fit our needs. Recently, we have been offered a bar which is reformed with controlled bearing features, which seems to have merit. Practically all of the foregoing bars are made 1/64 in. oversize with respect to height, to compensate for any slight wear that may have occurred on the fishing surfaces between the bar and the base of rail.

Briefly, a crowned bar should not be used with new or cropped rail. When used with worn rail, it should as nearly as practicable make contact with all points where contacts are made by new bars, at the same time providing sufficient latitude for the necessary take up. When bars are reformed they should be full height, for which reason it is well to specify an oversize in this dimension of 1/64 in.

Setting a Motor Car Off

What precautions should be observed in setting a motor car off the track, to avoid personal injuries?

Stop the Engine

By C. L. Fero
Supervisor of Work Equipment, Boston & Maine, Boston, Mass.

In these days of reduced forces, the so-called standard section motor cars which were purchased when section gangs averaged six to eight men, are entirely too heavy to be handled with safety by today's section gangs of two or three men. Most of the cars purchased prior to 1930 weigh about 1,000 lb. When it becomes necessary to remove such a car from the track, except at a road crossing or a motor-car setoff, with two or three, or even four, men, the operation is bound to be hazardous, and injuries may be expected.

Obviously, one solution to this problem is lighter cars, but until the heavier ones can be replaced with lighter units, setoffs at frequent intervals will tend to avoid the necessity for removal on open track. To be effective, a motor-car setoff should be provided with a platform between the rails, of sufficient height and length to permit the car to be turned by lifting the rear or light end only. On the other hand, so large a number of platforms as might be necessary for this purpose would obviously be objectionable. The need for them could be eliminated by providing each car with a light-weight, collapsible turntable, better known as a jigger, which can be taken apart easily and carried on the car.

Before any motor car equipped with a free-running engine is set off the track, the engine should be stopped, to avoid the possibility of accidental clutch engagement or tightening of the belt, revolving the driving axles and wheels, in which clothing might become entangled or hands or other parts of the body might be caught and injured. Furthermore, every man in the gang should be assigned a certain corner or lifting location, which he should always occupy when lifting the car from the track. This arrangement will result in better team work, which should tend to reduce personal injuries.

Many serious personal injuries have resulted, when setting motor cars off the track, from the practice of allowing men to lift on the side of the car and walk backward. This is a practice that should never be permitted. Many of the injuries which occur during the removal of motor cars can be avoided if the men are instructed properly by the foreman in the procedure they should follow, and if the instructions are enforced.

Injuries Avoidable

By O. H. Carpenter
General Roadmaster, Union Pacific, Cheyenne, Wyo.

While the handling of motor cars to and from the track has always been a fertile source of personal injury, most of them belong to the avoidable class, if proper methods of handling are employed. The fact is that this is a routine task that is performed every day, and every one in the gang is so familiar with it that he is too often led to the mistaken belief that no danger is involved, until sooner or later unsafe practices creep in and are not corrected until an injury occurs.

Different forms of car landings are used on different roads, including portable turntables or other devices for setting the car off the track. We use landings of earth and ballast, built up to the top of the rail with ballast filled between the rails. With this system the ballast tends to settle down and away from the rails as a result of the vibration from traffic, for which reason it is necessary to keep the ballast filled in and trimmed properly so that the car can be removed easily. Doing this also prevents damage to the car from bumping the wheels against and over the exposed rails.

Where the landing is in proper condition, four men are sufficient to remove a car from the track. Two men should lift the rear of the car and swing it around off the track while the other two put their weight on the front end to help balance it. After the car has been swung around at right angles to the track, the two men at the rear should each move to the side and push against the rear safety railing while the two men in front push against the front safety railing. In this way the car can be moved from the track onto the car landing.

If the car is a heavy extra-gang car or a trailer, more men will be required to handle it. It is usually best for the supervisor and foreman to work out the best method of handling such cars. In any event, every man should be assigned his place and be taught just how the car is to be handled, and the method and assignment should not be changed. Before starting to take a car off, all heavy tools, the water keg and any materials carried on the car, particularly those that might fall off, should be removed from the car.

One of the most frequent causes of injury arises because men walk too close to rolling wheels and get their toes under them while pushing the car from the track, or when pushing it along a track where ballast has been unloaded, at road crossings and at station platforms, and is level with the top of rail.

When necessary to remove a car at a place where there is no setoff, the front wheels should be lifted clear of the rails on the side to which the car is to go. The rear end is then swung around, and the front wheel lifted over the rail. Care must be exercised, especially with high rail, to avoid mashing fingers between the lifting handles and the top of rail.

Use Setoff Landing

By Supervisor of Track

Our cars are taken from the track only at regular setoff points, which are constructed of second-hand timbers at right angles to the rails and lead to an earth fill for a landing. A portable turntable is carried on each car, consisting of a center pivot, a cross member swinging on this pivot and two side members which are held at gage distance apart. These side members come to a feather edge at one end and are turned up at the other to form a wheel stop.

The motor car is easily run onto this device when the side members are placed over the rail, and when fully on it balances and can then be turned on the pivot. After it is swung 90 deg. the car is backed off onto the timber rails and run to the earth landing. Every man has an assigned position and must see that the car is kept balanced at all times.

A Place for Every Man

By Superintendent of Work Equipment

It is of first importance that every man handling a motor car have a clear understanding of what is to be done and just what is expected of him, or personal injuries are almost certain to occur when a motor car is being set off the track. While injuries that occur in handling motor cars to and from the track are numerous, they are seldom fatal, and the importance of their control is too often overshadowed by the more spectacular accidents in connection with collisions and derailments.

Injuries from handling motor cars include crushed feet, broken legs, strains, hernia, etc. As a rule, the cause is disposed of by charging clumsiness on the part of the injured man. Invariably, however, it can be traced to lack of understanding or of co-ordination in the handling of the car. Such accidents are wholly uncalled for and can easily be eliminated by proper training and ordinary care. Every man who is to take part should be given an assignment and it should be understood definitely what he is to do. Others in the gang should stand aside and take no part in the operation for they will not only interfere with the handling of the car but increase the probability of injury by force of numbers and the confusion of getting in each other's way. Car setoffs, when properly constructed and maintained, minimize the hazards connected with handling cars to and from the track.

It is common practice in large gangs to lift cars bodily from the track. This may be all right where there is a perfect understanding by all of the men involved. It is a dangerous practice without this definite understanding.

Designing an Exhaust System

How should the exhaust system from an internal-combustion engine be designed and installed?

Avoid Back Pressure

By C. R. Knowles
Superintendent Water Service, Illinois Central, Chicago

In general, the exhaust system of an internal-combustion engine consists of a muffler, which is part of the engine, and an exhaust pipe extending through the roof or the side of the building. More elaborate systems are sometimes necessary, depending on the location of the engine. Exhausts from internal-combustion engines should include a muffler, which is usually a large, cast-iron vessel located immediately adjacent to the engine. The exhaust gases are discharged into the muffler and thence piped to the atmosphere. The sharp report of the exhaust is thus reduced by converting it into a muffled sound, as the name of the device implies.

The exhaust makes more or less noise, even with the muffler, and where this is objectionable it is sometimes necessary to muffle the noise further by piping the exhaust into an underground pit, which is usually effective by eliminating practically all of the remainder of the sound of the exhaust.

It is important that the exhaust pipe be of sufficient size to avoid back pressure which, obviously, would act to reduce the efficiency of the engine. The size of the exhaust pipe should be not less than that of the exhaust outlet of the muffler. Where it must be of considerable length or contains a number of bends, it should be one or more pipe sizes larger than the muffler outlet. It is of special importance that all exhaust connections be tight, because of the danger of monoxide gas poisoning, particularly in closed rooms.

It should not be overlooked that considerable heat is transmitted to the exhaust pipe by the exhaust gases, for which reason proper precaution should be taken to prevent fire where the exhaust passes through walls, ceilings or roofs which may be constructed of inflammable materials.

Two Considerations

By Water Service Inspector

Among the considerations in designing an exhaust system for an internal-combustion engine, two are of the highest importance, namely, to avoid leakage and to insure free and rapid escape of the waste gases. Leak-

age always carries the possibility that the pump-room attendant or repairmen may become the victims of gas poisoning, while in some cases there may be a sufficient accumulation of explosive gases to cause trouble.

Free discharge is necessary to relieve the engine from back pressure. This implies an exhaust pipe of ample size, free from bends or elbows. If these are necessary or if the pipe must be unduly long, it may be desirable to increase its size to reduce friction and the resistance set up by the bends.

Care should be exercised, however, not to select a pipe too large for the purpose, and to protect it from low temperature. A large pipe allows the gas to expand as it leaves the muffler and this action tends to continue as it approaches the outlet. When a gas expands rapidly it cools, so that a pipe of too great diameter or exposure to low temperature tends to cause rapid cooling. This results in the condensation of oils and in deposits of soot in the exhaust line, which may give rise to backfiring, but in any event are highly undesirable.

I have not mentioned the exhaust pot or the engine connections, as these are worked out by the manufacturer, so that, in general, the design of the exhaust system begins at the outlet to the muffler. The important things are to avoid leakage and get the exhaust to the atmosphere with the least resistance, at the same time keeping the system balanced.

Allow No Leakage

By Engineer of Water Service

In designing an exhaust system, the most important consideration is to have the exhaust chamber of ample size and the pipe leading from it of large diameter, to insure free and rapid dispersion of the waste gases. Where the ceiling of the engine room is quite high, it will be better to put an elbow in the exhaust pipe and discharge to the atmosphere horizontally at a reasonable height above the ground. In this case the pipe should be two inches longer than the straight pipe to compensate for the friction at the elbow. The exhaust chamber or pot should set on a secure foundation and all connections should be made carefully, allowing no chance for leakage of the foul gases, which are usually heavier than air.

Distillate or other petroleum products are now used almost universally for the semi-Diesel type of internal-combustion engines commonly employed for pumping water and for other railway purposes. While these do not liberate fumes that are as volatile as those from gasoline it is desirable nonetheless to provide good ventilation to insure their rapid disposal.

Ordinarily, an engine of the semi-Diesel type, when maintained properly, discharges very little fumes other than those that are taken care of by the exhaust chamber and stack. If the engine is allowed to become badly worn or out of adjustment, the fumes liberated into the engine room may become highly concentrated. The revolving flywheels tend to keep the air in circulation and thus dispel the gases to some extent, but some accumulation may occur at the floor level and particularly in low places adjacent to the engine.

So far as practicable, it is well to construct the engine-room floor slightly higher than the ground surface, and to provide a small opening under the door where the gases may escape at the floor level. In an extreme case, and a comparatively large engine room, a motor-driven exhaust fan was installed in a 20-in. exhaust tube located near the engine with the inlet about six inches above the floor and the outlet above the roof of the building.

Pump pits or other deep depressions where men may be required to work should not be permitted adjacent to engines where it would be possible for combustion gases to flow and remain undisturbed. Where such depressions already exist, workmen should be cautioned about the possible danger of carbon monoxide gas poisoning or the accumulation of explosive gases.

How to Renew Bridge Ties

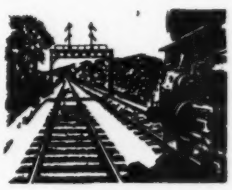
Is it preferable to renew bridge ties out-of-face or individually as they show signs of approaching failure? Why? How should the work be organized?

Prefers Spot Renewals

By H. Austill
Bridge Engineer, Mobile & Ohio, St. Louis, Mo.

As a matter of economy and conservation of material, I can see no justification for renewing bridge ties out-of-face when a large percentage of them may still be good for a number of years' service. There may be cases where the labor cost of installation is so high that one is justified in making renewals out-of-face when the maximum life of the better ties is only one or two years. Obviously, a decision on this point requires inspection and then cost studies.

A practical objection to renewing individual ties is that, in most cases, the new tie has not been fully seasoned and shrunk. For this reason, if it is sized to the net dimension of the old ties and then shrinks in seasoning, it will not carry part of its normal load. If, on the other hand, allowance is made for future shrinkage in seasoning, temporarily at least, the new tie will take all of the load that should be distributed to the adjoining ties. In practice I have usually followed the plan of taking enough of the existing ties from one end of the bridge to replace the scattered defective ties individually, and have then put in out-of-face an equal number of new ties to replace those that have been removed.



Renews Out-of-Face

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Regardless of the location or type of bridge, when it becomes necessary to renew any considerable number of ties, say six or more, they should always be renewed out-of-face. Otherwise it is almost impossible to insure smooth-riding track, because when new ties are spotted in they almost invariably take the load off the adjacent ties, causing lack of uniformity in the support of the rail. Furthermore, within a short time the new ties are likely to show signs of cutting, and sometimes of crushing, under the tie plates and over the stringer or chord, as a result of the overload to which they are being subjected.

Obviously, it might be unreasonably expensive to renew all of the ties in a long bridge which has only a few that are defective. In such cases we get around this difficulty by starting at some point, say at the end of the

bridge, and remove enough ties out-of-face to give us the number of second-hand ties required for spotting-in. It is for this reason that the minimum was set at six, for if a smaller number is involved there is little benefit in keeping the new ties together. Another important point is that where new ties are applied individually, one never has a completely new deck over any part of the bridge, or one that will ride smoothly, because it is almost impossible to maintain good line and surface where this is done.

Painting Waxed Surfaces

What methods should be employed in painting floors or woodwork that have been waxed? How can the paint be made to adhere?

Takes Patience

By General Inspector of Buildings

Peculiarly enough, many experienced painters are not aware that a wood surface that has been waxed can be painted with success. To do so, however, requires some skill and a great deal of patience, while the cost may be out of proportion to the benefits obtained. On the other hand, others are unaware that paint will not adhere to wax—until they have tried it. My recommendation is that, unless there is some good reason for applying the paint, the surface be re-waxed and that the painting be eliminated.

It is possible, however, by using proper methods, to remove the wax and do a successful job of painting. This cannot be done with the removers usually employed, for it is customary to apply the wax directly to the clean wood or over a stain. When this is done an appreciable amount of the wax will penetrate well below the surface where the remover has no effect on it, since it merely cleans the surface. Although the surface may appear to be clean and free from wax, neither paint nor shellac will adhere to it.

Benzine will dissolve the wax, both on the surface and in the wood pores, but the latter requires the most thorough scrubbing, which must sometimes be repeated; merely washing the surface will not be sufficient. In some cases even repeated scrubbing will not be satisfactory, in which event the only recourse is to use sandpaper until it is certain that bare clean wood is exposed.

If paint has already been applied over the waxed surface, or even after an attempt to clean it, it will be necessary to remove the paint before the benzine can be used. Needless to say, the utmost care should be exercised to prevent fire from reaching the benzine. Because it evaporates rapidly, the room should be well ventilated; no fires or other open flames should be allowed in the building; smoking should not be permitted in the vicinity; and the benzine should be removed from the building well in advance of the passage of trains.

Must Be Thorough

By Engineer of Buildings

This is a real problem, and unless one is prepared to do a thorough job it will be better to rewax the surface rather than to attempt to apply paint. Paint will not stick, but will scale and peel, so long as any of the wax remains on or near the surface of the wood, and this should be recognized as the most important item in connection with the proposal to do the painting. As usually applied in railway work, the wax may be expected to penetrate well into the pores of the wood, and none of the removers commonly used will do more than wash the surface. For this reason, more drastic methods are necessary if the painting is to be a success.

If the surface has not yet been painted it should be scrubbed with benzine. This is meant literally, for an ordinary washing is seldom sufficient, a thorough scrubbing being necessary to remove all traces of the wax. It hardly seems necessary to say that the most extreme precautions are necessary to prevent ignition of the benzine or its fumes while this operation is under way. Because of the inflammability of the benzine, and the possibility of an explosion, the work should never be done in a closed room, or in a building in which it is necessary to fire furnaces or stoves while the work is in progress. Smoking should be prohibited also.

If the painting has already been done and the paint is failing, all of the paint should be removed and the wax cleaned off in the manner already described. When it is certain that all traces of the wax are gone, the paint can be applied in the usual way.

How Should Ties Be Delivered?

Should ties be delivered in open-top or boxcars? Why?

Prefers Open-Top Cars

By J. W. Hinton
Section Foreman, Southern, Vance, Ala.

My experience is that it is safer to unload ties from open-top cars than from boxcars and the unloading can certainly be done at less cost. Even where the gangs are small, very little time is consumed in unloading from open-top cars. When unloading from a moving train, the men unloading ties can see signs and other stationary objects and can, therefore, drop the ties without damage to them. Furthermore, ties can be unloaded on narrow fills with greater accuracy, and not so many of them will roll down the slope, from which they must be carried back.

In extremely hot weather, and this is an important consideration in this section of the country, the men are able to breathe more freely in the open air than in the heated enclosure of a boxcar and are, therefore, less likely to be overcome by the heat. Again, ties loaded crosswise in an open car can be landed in position to eliminate an extra handling before they are inserted in the track. In most cases ties that have been unloaded from boxcars must be given this extra handling. Taken all in all, the advantages are all in favor of delivering ties in open-top cars rather than in boxcars.

Less Hazard in Open Cars

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Obviously, the type of cars to be used for delivering ties will depend in large measure on the types that are available and other factors, regardless of their importance, will have little effect on the decision. Assuming, however, that cars are plentiful, I would choose flat-bottom gondolas, of sufficient width to allow the ties to be placed crosswise. Ties loaded in this manner can be lifted over the side of the car with little

effort and landed quite accurately with little danger of damage. Another advantage of open cars is that less men are required to unload a given number of ties in a given time; in other words, the productive effort of the men is higher. When unloading from boxcars, the ties must be pushed out and there is little accuracy in unloading them.

It is more difficult and costs more to load ties into box or stock cars than into open-top cars at the treating plant. In unloading them, there is always the hazard of falling ties if the train starts or stops suddenly, while the men working at the opposite ends often interfere with each other, for it is practically impossible for them to synchronize their movements.

Finds Many Factors

By C. D. Turley
Chief Tie Inspector, Illinois Central, Chicago

In determining the type of cars to be used for shipping ties to the point of use, safety, economy, the method of unloading and the equipment available for non-revenue service should all be given consideration. If the ties are to be unloaded from cars spotted on sidings, and a small section gang with an alert foreman is to do the unloading, either box or stock cars can be used to advantage, with little danger of injury to the men.

If the ties are to be distributed along the track from a work train, open-top cars should be used, since the men in the cars can get a better view of what is going on, and are visible to the trainmen. Careful operation of the train and strict supervision of the men are necessary to reduce the probability of personal injuries.

From the standpoint of economy, open-top cars are more desirable, since more ties can be handled in proportion to the number of cars; that is, more men can work to advantage in an open-top car than in a boxcar. When a work train is involved, a larger force for unloading the ties will tend to reduce the work-train expense. Another opportunity for economy will be found in the use of cars not in demand for revenue service. For example, coal cars are well suited for shipping and unloading ties, and there is usually a surplus of these cars during the summer months, the period when ties are most in demand. Stock cars can also be used to advantage for shipping ties, and are usually readily available during the working season, since stock shipments are at the minimum at this time. Not infrequently it is possible to load cars in revenue service with ties and route them toward their point of revenue loading and thus eliminate the large amount of empty-car mileage that would otherwise result.

Load With Empty Movement

By L. L. Adams
Engineer Maintenance of Way, Louisville & Nashville, Louisville, Ky.

Several answers are possible, depending on the viewpoint from which the question is being considered. From the viewpoint of cost at the treating plant, it is much cheaper to load ties in open-top cars than in boxcars, especially where cranes are being used for handling the ties, which is the common practice at treating plants. In unloading the ties by hand for use along the line, it is preferable that they be loaded in boxcars, since they can be unloaded from cars of this type with less danger of personal injury to the men who are handling them. Again, there is less danger of damage to the ties when they are dropped from the door of a boxcar than when they are thrown over the side of a gondola car.

Probably the most important point to consider is the type of equipment that is readily available for making the shipments. Treated ties, particularly if they have been treated with creosote, should not be loaded in boxcars that are suitable for loading merchandise, and for this reason it is often difficult to obtain boxcars suitable for loading ties. On the other hand, coal cars are not affected by loading creosoted ties in them, and as this type of equipment is usually available in greater numbers than the boxcars that can be used for these shipments, there may be little opportunity for making a choice. Consideration should also be given to using equipment that is moving empty in the direction of the points where the ties are to be delivered, thus avoiding extra handling of empty cars.

Bracing Bents Under Water

How does one apply sway bracing on a pile bent where the cap is so near the water that the brace plank cannot be applied above the water?

Employs a Diver

By L. G. Byrd
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

As in many other cases the answer depends on varying factors, including the design of the bridge, the depth of the water, the strength of the current, whether the water level is uniform or fluctuating, the class and density of traffic, and other conditions. If the bent is only 5 or 6 ft. high above the bed of the stream or pond, no bracing will be necessary. If the height is from 6 to 10 ft. and the water disappears during dry seasons, a six-pile bent will carry safely until low water, when the braces can be applied in the open.

If the trestle is in an important track and the bent is more than 10 ft. high, the braces should be applied at once. If it is submerged continuously the best thing is to employ a diver to bore the holes, place the brace plank and bolt them up. I am aware that this is somewhat expensive, but it is better and cheaper in the long run than to employ makeshift methods which are never satisfactory.

In many cases the bents can be stiffened by applying sash braces a few feet below the caps and using struts between the piles. This should not be relied on, however, if the bent is more than 12 ft. high and is in a high-speed or heavy-traffic main line.

First-Class Job Best

By General Bridge Inspector

Many ingenious plans have been tried out to apply bracing to submerged bents, but in the main they have not given satisfactory results. The most common is to bolt a brace plank to the outside pile before it is driven, hold it in place until the cap is applied, and then secure the other end. This, of course, does not care for the intermediate piles, but unless the bent is a high one it may add enough stiffness to make a passable job. Another scheme is to secure a cable at about the point on each outside pile where it will be just above the bottom and then loop it around the remaining piles, drawing it taut, after they have been driven. If properly done this will add considerable lateral stiffness to the bent, but is is difficult to do the job right and if either of the cables slips the whole situation is back where it started.

If it is intended to do the job right, a diver should be employed to apply the braces after the bent is driven and the cap is in place. Obviously, the use of a diver will increase the cost to some extent, but no road has many cases of this kind, and the aggregate expense for all such structures will be but a small part of their total cost. Where an experienced diver is employed to apply the bracing, one can be assured of a dependable job, while one is never sure that any other method is dependable.

What Width for the Roadbed?

What is the proper width of roadbed for single track? For double track? Why? What effect does a roadbed wider or narrower than this have on track maintenance?

Ballast a Factor

By G. S. Fanning
Chief Engineer, Erie, Cleveland, Ohio

The proper width of roadbed for single track depends entirely on the ballast section. On a fill, the roadbed should have a berm on each side outside of the toe of the ballast, with a minimum width of 18 in. This width will take care of any rounding of the top of the slope and provides a convenient shelf for workmen, tools and materials. In cuts, the same width of roadbed should be maintained, with the side ditches entirely outside of this width.

For double track, the width of the roadbed should be increased by the distance between track centers. A wider roadbed involves an unjustifiable expense. If additional material is available for fills it might better be placed at the toe of the embankment to reduce the slope. In cuts, any additional excavation that may be made might, similarly, be made by widening the cut at the top so as to stabilize the slope. A narrower roadbed than that indicated results in loss of ballast over the slope of fills, and into the side ditches of cuts. In addition, the maintenance workmen find no place for a foothold.

Many Variable Factors

By H. R. Clarke
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Chicago

So many variable factors must be taken into consideration that I think it scarcely possible to set any single width of roadbed as the standard or proper width. Among the more important of these factors are the kind of material, the standards of the line and the extent to which the roadbed may erode.

Probably the first factor to consider is that of the standard for the line. If the project involves a spur track or a light and unimportant branch line, a lower standard will be adopted and a comparatively narrow roadbed would be proper. On the other hand, if an important, high-speed, heavy traffic line were under construction, the standards would naturally be higher and a greater width of roadbed would be called for.

If the material that is being used in the construction of the roadbed is of poor quality it is quite probable that a roadbed of greater width, with easier slopes, would be necessary than if the material were stable. Also, if it is expected that there will be considerable erosion, either from wind or water, before the roadbed becomes fully stabilized and protected by vegetation, doubtless it would be wise to use a greater width in the original construction to provide for the shrinkage that may reasonably be expected to occur. To establish the right standard, each piece of work calls for individual study and what might be called the general standards of the road should be modified to fit the condition existing in each particular case.

If the roadbed is too narrow it will not be possible to maintain the track to the desired standard. Under modern traffic a certain mass in the roadbed is required to give the necessary stability; if this is not present, the track will not hold to line and surface. If the roadbed is too narrow, ballast will not be retained in place, but will run down over the subgrade and over the shoulder.

A roadbed wider than necessary properly to meet the conditions involves the moving of excess material, which is objectionable by reason of increased cost. There is also the possibility that if the fill is too wide some difficulty in drainage may be experienced, that would not be encountered if the bank did not have excess width.

Believing that, as stated, each case calls for individual consideration, it is obvious that I cannot suggest a single standard, but I would suggest that, for even the least important track, 18 ft. be established as the minimum and for important tracks 24 ft., these widths to be subject to modification in individual cases. These widths are for single track; for double track they should be increased by the distance between track centers, which should not be less than 14 ft. in all cases.

Through cuts I consider it advisable to hold the roadbed to the same width as on fills, the total cross-section of the cut to be determined by the width of the ditches which may be necessary outside of the roadbed section. Three feet should be the minimum for the width of the ditch, and this would need to be increased under some conditions where a large amount of water has to be handled or other unfavorable conditions exist.

Prefers 20 Ft.

By J. Morgan
Supervisor, Central of Georgia, Leeds, Ala.

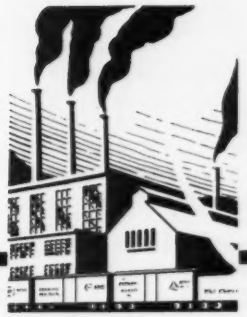
So many factors are involved in this question that no single answer can be given which will cover all cases. The kind and quality of material, whether the roadbed is in a cut or on a fill, the foundation upon which embankments rest, whether cuts are through rock, clay, hardpan or common earth, the chances for erosion, the drainage conditions and the character of the line are some of the matters which must be given consideration.

A roadbed should be wide enough to support the ballast and leave room for the handling of maintenance material. By this I mean that there should be ample room to get ties and rails into and out of the track. To do this, a single-track roadbed on embankment needs to have a minimum width of 18 ft., and in cuts, of 20 ft.

These are minima and refer to stable materials. One can scarcely venture a suggestion for those where a greater width may be necessary, because every such case is a special one that must be decided on its merits in the light of local conditions that are imposed.

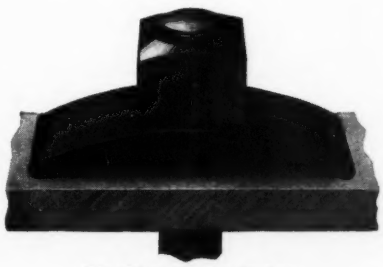
It seems pertinent to say that uniformity of width is as essential as adequate width, particularly on embankments. If the roadbed is alternately wide and narrow, the surface will be affected adversely, for a fill that is overwide tends to hold moisture, while places that are too narrow fail to support the track in the proper manner.

New Products Of the Manufacturers



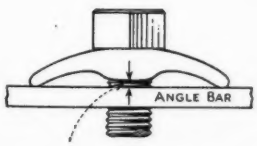
Woodings Improves Triflex Spring

THE Woodings-Verona Tool Works, Verona, Pa., has introduced an improved design of its Triflex spring, which embraces several improvements over the older design while retaining the original basic principle. As in the first design the object is to offer a means of providing a high reactive spring pressure on track bolts, together with a means of affording an accurate measure of the tension so produced.

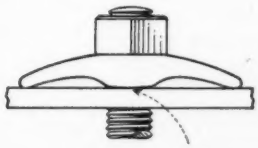


The New Triflex Spring

In the original design this was accomplished by forging a small channel section into a flat arch with a short reverse curve at the crown that is convex downward, this arch spring being so proportioned that the desired tension is attained when the sofit of the convex curve has been brought in contact with the face of the joint bar. In the new design these springs are formed by shearing short pieces from a special rolled bar of such section as to provide the desired arch contour, a thickening at the middle of the span serving the same function as the reverse curve in the old design. These springs are 2 in. wide by $4\frac{5}{16}$ in. between supports and are said to fit standard AREA joint assemblies without any change in bolt lengths. They are made of alloy steel.



Start—Bolt Tension Zero



Finish—Fixed Tension

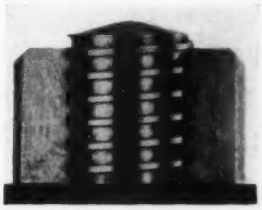
Among the advantages claimed for the new design is a higher spring reaction. In addition, it provides a longer travel from free height to contact, and a better bearing of the nut on the top of the spring, which result in a reduced frictional resistance to the turning of the nut, and therefore require a minimum of wrenching in application or removal of the bolts. It is claimed, also, that the device provides a wider distribution of bolt stresses to the joint bars, thus holding them more effectively in position to function properly.

Lock-Thread Track Bolts Gain Acceptance

FOLLOWING extended service tests, a number of roads are now employing Dardelet track bolts in considerable quantities for rail joint assemblies. One large western road has adopted this type of bolt as standard, after finding through extensive tests that this fastening, for its particular track and traffic requirements, produces better joint conditions than standard U. S. thread bolts, reduces maintenance expenses, and is more economical in first cost than the standard bolt assembly.

The Dardelet bolt and nut assembly, which is of the self-locking type, is similar in character to the standard bolt and nut assembly except for the thread design, which is of a modified square type with a locking slope at the root of the male thread which rises toward the point of the bolt, and a corresponding slope on the ridge of the female thread. When not under load, the nut is finger free, but while in engagement with the work the opposed sloping faces of the thread are wedged against each other in an axial direction by the bolt tension, in which position they are securely locked together.

The road, which has standardized on the Dardelet track bolts, first began tests of these bolts in 1930, when a small installation was made in a section of main-line track. Results with this installation appeared so favorable that two track miles of main-line joints were equipped with the bolts in 1931. At the same time, two additional miles of track in the same vicinity were fitted with new standard U. S. thread bolts of the



Locked

Unlocked

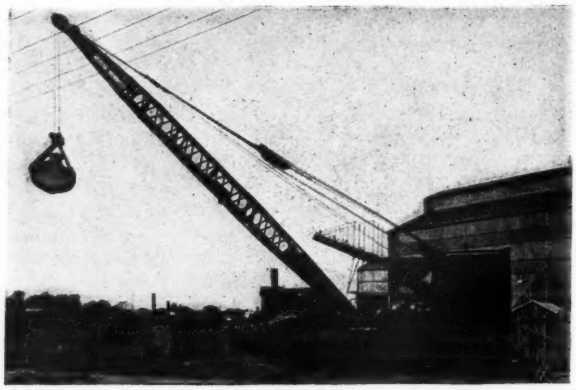
The Bolts and Nuts on This Track Joint on the New Haven Have Dardelet Threads

same diameter for comparative purposes.

Frequent inspection of these track joints and bolt assemblies over a period of three years, all under the same general track and traffic conditions, showed that the locking thread bolts remained tight longer than did the standard thread bolt assemblies. Coupled with this better performance of the locking thread bolts was the fact that their first cost was less than that of the standard thread bolt assemblies. These facts led the road to specify Dardelet bolts for all of the 100-lb. rail which it laid in 1935, and again for its entire rail requirements for the year just closed.

Introduces New Locomotive Crane

THE Industrial Brownhoist Corporation, Bay City, Mich., has recently added a new model, known as No. 9, to its line of Diesel and gasoline powered locomotive cranes. The new model is a heavy-duty crane having a capacity of 40 tons when in free-running order and of 50 tons with outriggers in place.

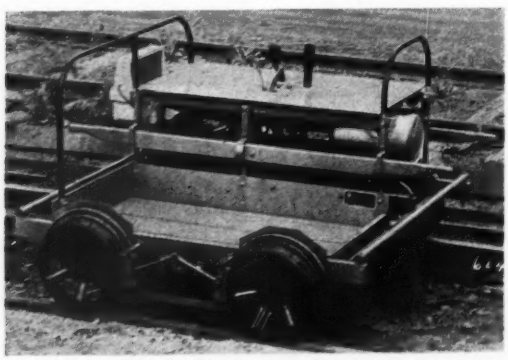


The Industrial Brownhoist No. 9 Locomotive Crane

In order to assure low operating costs, ease of operation and flexibility of travel, a number of noteworthy features have been incorporated in this model. Among these are a two-speed hoist mechanism; four travel speeds embodying a top speed of 15 miles per hour; and a helical worm-gear drive which is mounted on anti-friction bearings and runs in an oil bath. In addition the crane crab and engine are mounted on a one-piece steel casting, the travel gears under the car operate in oil-tight cases, and the design is such that when the crane is traveling the crab is disengaged.

Improvements in Fairmont "59" Car

FAIRMONT Railway Motors, Inc., Fairmont, Minn., has made a number of additional improvements in its Model "59" one- and two-man inspection car, the improved model being designated as series "C". The "59" car was first introduced in 1931 and a number of improvements were described in *Railway Engineering and Maintenance* for September, 1934. This car has now been equipped with Timken bearings in all five axle boxes, double rows of rollers on a single long axle sleeve or inner race, no-lug thrust collars, and covered, underslung oil cups which are readily accessible through the spaces between the wheel spokes

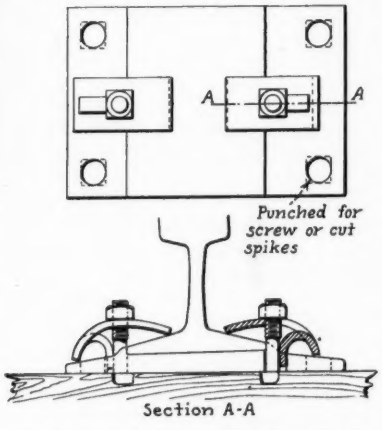


The Fairmont "59" Series C Inspection Motor Car

Other improvements include the provision of 14-in. standard demountable wheels made from ¼-in. cold formed plate; a front safety railing of full height and width; and side sills and a front cross beam that are ¼ in. thicker than heretofore. In addition the seat top, belt guard and inner side of the tool tray are now made of Masonite. New extra equipment includes a windshield that is wider at the top, electric lighting fixtures, wide left wheel guards and 17-in. wheels.

Compression Track Fastenings

THE Rails Company, New Haven, Conn., has developed a compression type of fastening for securing the rails in track, which involves a pair of spring clips and bolt assemblies that exert pressure on the rail base, replacing the ordinary rail-holding track spikes. It grips the rail firmly, and is said thereby to control expansion and contraction effectively and prevent longitudinal movement of the rail as a whole in either direction. A special feature of the fastening is that it can be used with any of the various sizes and designs of tie plates in common use and already in track, regardless of punching or shoulder construction.

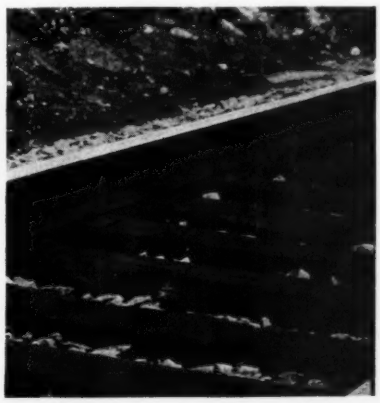


Sketch of the Compression-Type Track Fastening As Applied to a Rail

The clip of the fastening is a single curved section of tempered spring steel 2 in. wide, ¼ in. thick, and approximately 3¾ in. long, which bears on the base of the rail at one end and on the top of the plate shoulder at the other end. The clip is held in place by means of a hooked-end bolt with a specially flattened shank, which passes through the clip and through one of the rail spike holes in the tie plate to

locking engagement with the bottom of the plate. By turning down a nut on this bolt the spring is compressed sufficiently to produce its spring action on the base of the rail. The bolt and nut assembly is made of copper-bearing, heat-treated steel. A special feature of the clip is a tongue-like section, $\frac{5}{8}$ in. wide, punched out of it and bent downward to fit into the tie plate spike hole directly back of the bolt. This and the bolt shank fill the hole, with only sufficient clearance to permit ready installation.

Placing the bolt in position with its hooked grip on the underside of the tie plate requires the denting of the top surface of the tie directly beneath the bolt to a depth of $\frac{7}{16}$ in., the thickness of the hooked head of the bolt. This is done by placing a square-shanked track punch with a



One Road Has Applied a Large Number of the Fastenings to Alternate Ties

beveled end in the spike hole and striking it with a maul or sledge.

When the bolt has been set in the plate hole and the spring clip placed tentatively in position, the nut is first applied to light contact with the clip. Then, by striking the rear of the clip lightly, it is driven forward, forcing the tongue into the hole back of the bolt, and, at the same time, the hook of the bolt beneath the base of the plate. The nut is then turned down as necessary to contact with the spring, following which one complete turn under load is said to produce the desired spring pressure on the rail base. In conjunction with the compression fastening of the rail on each side, it is, of course, necessary that the tie plate be anchored to the tie on each side by one or more lag screws or cut spikes in order to hold the rail to gage.

Advantages claimed for the compression track fastening are that it utilizes existing tie plates; holds the rail against longitudinal movement in both directions, thereby maintaining uniform joint openings with their attendant advantages; precludes spike-killing of the tie; permits flexibility in the track structure; and, with the necessary tie plate anchorage, insures the maintenance of proper track gage.

The number of ties in a panel which it is necessary to equip with the compression fastenings to hold the rail against longitudinal movement depends upon local conditions. The equipping of as few as four to six ties is proving adequate in certain cases, while one road, which plans to use the fastenings in connection with its entire 1937 rail requirements, has been equipping alternate ties and expects to continue this practice. Another road, which is employing the fastenings on 6 to 12 ties per panel in ballasted track, depending upon conditions, is equipping every tie on open-deck bridges with this type of fastening.

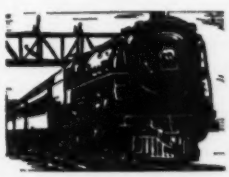
New Books

Wood Preservers' Proceedings

PROCEEDINGS of the American Wood-Preservers' Association for 1936, 582 pages, 6 in. by 9 in. Illustrated. Bound in cloth. Published by the association, 1427 Eye Street, N. W., Washington, D. C. Price $6.

Thirty-six papers and committee reports together with the discussions which followed their presentation are contained in this volume of proceedings of the thirty-second annual convention of the association. These reports and papers cover a wide range of subjects relating to the treatment of wood to make it resistant to decay and attack by insects or to render it fire proof.

Among the committee reports of special interest are those on service records of ties, marine piling and fence posts; an extensive bibliography on the fireproofing of wood; and revision of the specifications for the treatment of ties and of timber and lumber. Papers of particular interest to maintenance officers are those on Research on Termites in the United States and the Experience of the Central of Georgia with Treated Timber. Other papers containing much information of value with respect to preservatives and treatment are, Creosotes—Their Toxicity, Permanence and Permanence of Toxicity; Toxicities of Creosote and other Coal-Tar Products Extracted from Hardwood Ties Which Had Been in the Track for 20 Years or More; Clean Treatments; and Creosote Treatment of Pack Pine Wood.



The statistical section contains the twenty-seventh annual report, for 1935, of the quantities of wood treated and preservatives used in the United States, by R. K. Helphenstine, Jr., of the Forest Service, Department of Agriculture.

Wrought Iron

WROUGHT Iron, by James B. Aston and Edward B. Story, consulting metallurgist and chief metallurgist, respectively, A. M. Byers Company. 6¼ in. by 9¼ in. 59 pages. Bound in cloth. Published by A. M. Byers Company, Pittsburgh, Pa. Price $1, but free copies may be had on request on letter-head of potential users of wrought iron and faculties of engineering schools.

The fact that wrought iron is now available in quantities and sizes not previously to be had on a commercial basis has stimulated renewed interest in an old material, and this book has been written with the object of providing authoritative information concerning it, as well as to point out the opportunities for its use. The reader's interest is aroused by an opening chapter on the history of wrought iron from prehistoric times to the present, and this is followed by an account of the efforts to supplant the costly puddling process that led eventually to the discovery of the Aston, or Byers, process. Other Chapters explain the physical nature of wrought iron with its inclusion of many minute fibres of slag and show how this peculiar structure affects its corrosion resistance. Also included are a discussion of specification requirements, a review of the uses of wrought iron, some suggestions for material selection and a glossary of terms relating to wrought iron manufacture and its products.

News of the Month

Railroad Employment Shows Further Increase

Reflecting increased railroad activity, employment on the Class I railroads of the United States continued the uptrend in November which has been in evidence for a number of months. In that month the Class I railroads reported to the Interstate Commerce Commission a total of 1,092,080 employees, an increase of 78,628, or 9.63 per cent, as compared with the same month in 1935. The number of employees in the maintenance of way and structures group showed an increase of 12.4 per cent while employment in the maintenance of equipment and stores group increased 7.58 per cent and in the train service group 10.06 per cent.

Tells Employees How to Protect Jobs

Employees of the Norfolk & Western were urged to study proposed legislation and express, through their representatives, opposition to measures that are against their own best interests and which, if adopted, will reduce traffic and employment on the railroads, by W. J. Jenks, president of the company, in his annual Christmas and New Year message. Mr. Jenks pointed out that today the transportation industry is keenly competitive and that "future legislation that imposes substantially higher costs upon the railroads will drive business to other forms of transportation, which means decreased work and employment for railroad employees." On the other hand, he noted the general recovery in business during the past year, and stated it to be his belief that "we will march on to greater success."

Revenues Continue Upward Trend

The Class I railroads of the United States for October had a net railway operating income of $89,851,409, which was at the annual rate of return of 2.73 per cent on their property investment, as compared with a net of $75,454,501, or 2.29 per cent, in October, 1935, according to reports compiled by the Bureau of Railway Economics. Operating revenues for October amounted to $391,457,301, as compared with $341,039,092 in October, 1935. Operating expenses totaled $261,212,360 as against $232,521,777.

In the first ten months of 1936 the railroads had a net railway operating income of $524,627,844, or 2.36 per cent, as compared with a net of $396,656,269, or 1.78 per cent, in the first 10 months of 1935. Operating revenues for the first 10 months of 1936 totaled $3,321,921,613, as compared with $2,852,818,220 for the same period in 1935. Operating expenses for the 10 months amounted to $2,425,814,173, as compared with $2,149,914,981, for the comparable period of 1935.

Air-Conditioned Cars Show Increase

The railroads and the Pullman Company, in the last six months, have increased by 1,698 the number of air-conditioned passenger cars in operation, according to a statement by J. J. Pelley, president of the Association of American Railroads. This brings to 7,846 the total number owned and operated by the railroads and by the Pullman Company as of October 1 of this year. Of that number, the railroads had 3,777 air-conditioned passenger cars, compared with 2,731 on April 1, 1936, an increase of 1,046, including 2,185 passenger coaches, (771 added within the last six months) 874 dining cars, and 718 units of other classes of passenger equipment.

The Pullman Company on October 1 had 4,069 air-conditioned passenger cars, of which 652 were equipped with air-conditioned devices in the last six months. These cars include not only sleeping cars but also other passenger equipment.

Railroads Plan Large Expenditures in 1937

During December additional railroads announced that they would make large expenditures for new equipment, additions and betterments and routine maintenance in 1937. The Southern Pacific has announced plans for the construction and rebuilding of passenger, freight and motive power equipment to cost more than $16,500,000, bringing the company's total appropriation for new and modernized cars and locomotives during the last 12 months to more than $41,000,000. A program of rehabilitation calling for the expenditure of $33,000,000, the completion of which will depend upon a continued rise in the company's revenues, has been announced by the Great Northern. Of the total $22,000,000 will be spent for regular maintenance work, $6,500,000 for new equipment, $2,750,000 for rebuilding 11,000 freight cars in the company shops, and $1,750,000 for rails and fastenings.

The St. Louis-San Francisco will spend $5,357,353 during 1937 on new passenger and freight equipment and for mechanical and roadway improvements. Of this sum $2,857,132 will be used for the rebuilding and improving of rolling stock, a total of $1,160,297 will be spent for rails and other track materials, $1,002,553 will be spent on bridges, trestles and culverts and $119,100 will go for the installation of block signals and interlocking. Plans of the Missouri Pacific call for the expenditure during 1937 of $8,552,302, of which $5,697,942 will be chargeable to Capital Account. Expenditures for track material and labor necessary for laying new rail will total $2,671,470. Other major items include the installation of 235 miles of automatic block signals at a cost of $559,000, a new enginehouse at Atchison, Kan., $114,000, and a 12-stall extension to the enginehouse at Kansas City, Mo., $125,870.

Rail Orders During December

The rail market continued active during December, with orders for more than 300,000 tons of rail being announced during the month, but, with most companies having contracted for their requirements for 1937, the activity tended to taper off towards the end of the period. The largest order announced during the month was that of the Atchison, Topeka & Santa Fe, for 116,916 tons of rail, and 38,100 tons of track fastenings. Other large orders were those of the Baltimore & Ohio for 52,000 tons and that of the Norfolk & Western for 40,000 tons. In addition, the Chicago, Milwaukee, St. Paul & Pacific ordered 30,000 tons; the Erie 21,333 tons; the Delaware, Lackawanna & Western, 17,175 tons; the St. Louis-San Francisco, 13,500 tons; the Chicago & Eastern Illinois, 7,000 tons; the Grand Trunk Western and the Reading, 5,000 tons each; and the Central of New Jersey, 2,000 tons.

I.C.C. Refuses to Extend Emergency Rates

The emergency freight charges which, since April 18, 1935, have been superimposed on a large part of the basic freight rates of the rail and water carriers of the United States, terminated with the end of the year as the result of a decision of the Interstate Commerce Commission made public on December 19, denying the petition of the Class I roads for a continuance of the charges. The emergency charges have been producing approximately $10,000,000 of revenue a month and for the first ten months of 1936 amounted to $99,521,000, according to the railroad estimates, whereas, the net income for the period was estimated at $88,793,814, and it was asserted that many important railroads would have incurred deficits without the emergency charges. However, in its decision the commission pointed to the increased earnings of the carriers and arrived at the "unmistakable conclusion" that the emergency which it undertook to meet in its original decision in March, 1935, "does not now exist."

Association News

Roadmasters Association

The executive committee met in Chicago on December 28 with President B. E. Haley, Vice-President W. O. Frame and A. H. Peterson, Assistant Secretary C. A. Lichty, Treasurer E. E. Crowley, Directors R. L. Sims, E. P. Safford, W. S. Lacher, J. J. Clutz, F. B. LaFleur and W. H. Sparks, and Past Presidents A. Chinn and Elmer T. Howson in attendance. The recommendation of the hotel committee that the Hotel Stevens, Chicago, be selected as convention headquarters for the fifty-second annual meeting on September 21-23, 1937, was approved. The committee gave major consideration to the selection of committees to report at the next convention.

Metropolitan Track Supervisors Club

The last meeting of the club, held in conjunction with the annual dinner of the New York Railroad club, was one of the most largely attended and successful meetings of the current season. Approximately 60 members and guests, including a number of higher engineering and maintenance of way officers from points in New England and the South, were in attendance. The meeting was addressed by I. H. Schram, engineer maintenance of way of the Eastern district of the Erie, on New Developments in Track Maintenance. Following Mr. Schram, a prolonged discussion centered principally around the subjects of ballast cleaning, long welded rails, the repair of driver burns by welding, and new developments in work equipment.

Wood-Preservers' Association

The Association will hold its thirty-third annual meeting at the Roosevelt hotel, New Orleans, La., on January 26-28. The sessions on the first day will be devoted primarily to the consideration of measures for the perfection of practices for the treatment of timber in various forms. A feature of the program of special interest to railway men is the Users' Day session on Wednesday forenoon, January 27, at which W. B. Gregory, professor of experimental engineering, Tulane university, will present a history of the Lake Pontchartrain trestle of the Southern Railway; C. S. Kirkpatrick, chief engineer of the Missouri Pacific Lines at Houston, Tex., will speak on Twenty-Five Years Experience with Ties and Timbers from the User's Standpoint; and W. F. Clapp, marine biologist, Duxbury, Mass., will speak on Future Research on Marine Borer Problems. On Friday members of the association will visit the saw mills of the Great Southern Lumber Company at Bogalusa, Miss., and will also inspect the Pontchartrain trestle.

The C. & E.I.-L. & N. railways will operate a special train for persons attending the convention, leaving Chicago Sunday morning, January 24, with connecting cars from New York City, Pittsburgh and St. Louis joining the train at Terre Haute, Ind. The party will visit the treating plant of the Indiana Wood Preserving Company at Terre Haute on Sunday afternoon, and the plant of the Wood Preserving Corporation at Montgomery, Ala., on Monday forenoon, arriving at New Orleans Monday evening.

Maintenance of Way Club of Chicago

On December 14 the club held a joint meeting with the Chicago Section of the American Welding Society, which was attended by some 200 members of the two groups and their guests. The Welding and Heat Treating of Rail Ends was the subject of papers presented by Armstrong Chinn, chief engineer of the Alton, and C. B. Bronson, inspecting engineer, New York Central, the former dealing with the gas process and the latter with the electric arc process, while S. E. Tracy, track welding supervisor of the Chicago Burlington & Quincy, read a paper on Welding Open Hearth and Manganese Frogs.

The next meeting of the club will be held on January 18 when A. N. Reece, chief engineer of the Kansas City Southern, will speak on the topic "How Strong Should Track Be?"

Bridge and Building Association

A meeting of the executive committee was held in Chicago on December 12, with President E. C. Neville, Vice-Presidents C. M. Burpee, F. H. Masters, C. A. J. Richards and W. S. Lacher, Secretary-Treasurer C. A. Lichty, Directors F. H. Cramer, B. R. Meyers and R. E. Dove, and Past Presidents F. E. Weise and Elmer T. Howson present. The Hotel Stevens was selected as the headquarters for the forty-fourth annual convention, which will be held in Chicago on October 19-21, 1937. Arrangements were made to launch an aggressive campaign for members by bringing the work of the association to the attention of railway officers engaged in the construction and maintenance of bridges and buildings and water service facilities. The executive committee then selected the personnel of the committees to study and prepare reports on the subjects selected for investigation during the ensuing year and the president and secretary are now advising these members of their appointments.

Railway Tie Association

Members of the executive committee met in St. Louis on December 2. R. H. White, Jr., vice-president of the Southern Wood Preserving Company, Atlanta, Ga., who was elected second vice-president at the annual meeting of the association, was advanced to first vice-president to succeed the late Edward A. Morse. Meyer Levy, vice-president of the T. J. Moss Tie Company, St. Louis, and a member of the executive committee of the association, was elected second vice-president to succeed Mr. White. J. J. Schlafly, president of the Potosi Tie & Lumber Company, St. Louis, was elected a member of the executive committee to fill the vacancy caused by the elevation of Mr. Levy.

Action on the selection of a meeting place for 1937 was deferred until a later meeting of the executive committee, to be held in New Orleans, La., during the convention of the American Wood-Preservers Association. The executive committee approved the appointment of committees on Crosstie Specifications; the Checking and Splitting of Ties; Legislation, and Standardizing and Boring of Ties.

American Railway Engineering Association

Bulletin 390, containing five committee reports, was mailed to members on December 30, and Bulletin 391 with four reports, will go into the mail during the first week in January. Two more bulletins are to be issued in January and one in February. All except nine of the committee reports have been placed in the secretary's hands, and it is expected that these will be received shortly. The new Manual will also be ready for distribution about the middle of January.

Four committees held meetings in December, these being Records and Accounts, at Washington, D. C., on December 3; Water Service, Sanitation and Fire Protection, at New York, on December 4; Rail, at New York, on December 10; and Rules and Organization, at Chicago, on December 11. Three committee meetings are scheduled for January, as follows: Rules and Organization, at Chicago, on January 11; Maintenance of Way Work Equipment, at Baltimore, Md., on January 11, and at Philadelphia, Pa., on January 12; and Yards and Terminals, at New York, on Jan. 20 and 21.

Eastern Railroads Plan Snow Trains

Eastern railroads have made elaborate plans for capitalizing this winter on the growing popularity of "snow train" excursions. During the fall and early winter months such trains were advertised extensively in Eastern metropolitan centers where they will originate. The New York, New Haven & Hartford has set up a program of named snow trains to be inaugurated on January 3 by the "Snow Clipper," operating out of New York to Pittsfield, Mass., in the Berkshires. Other trains operated to the Berkshires by this company will be known as the "Snow Express," the "Snow Special," the "Ski Meister" and the "Snow Train, Jr."

The New York Central will operate snow trains to various points in the Adirondacks, the Catskills, the Green Mountains and Bear Mountain, while the Pennsylvania is operating snow trains out of both Philadelphia and New York. The Erie, beginning January 1, will operate Sunday snow trains out of New York, to points in New Jersey and Pennsylvania, while the D. L. & W. plans seven Sunday trains to the Pocono Mountains.

Personal Mention

General

R. D. Tobien, assistant to the chief engineer of the Southern, with headquarters at Birmingham, Ala., has been appointed assistant general manager, with the same headquarters.

F. C. Flynn, supervisor on the St. Louis Terminal division of the Wabash, St. Louis, Mo., has been promoted to assistant trainmaster, with headquarters at Moberly, Mo.

W. O. Tracy, at one time a resident engineer on the Norfolk & Western, who has been appointed general superintendent of the Western General division of this company, as reported in the December issue, was born in Winchester, Ky., on May 25, 1885, and was educated at Kentucky University. He began his railroad career with the Norfolk & Western on November 17, 1905, as a rodman in the engineering department on the Pocahontas division. In November, 1907, he was appointed inspector on the Norfolk division, and became a transitman in 1911. In 1913 he was appointed assistant resident engineer on the Pocahontas division. He later served as resident engineer on the Radford division, and in

W. O. Tracy

September, 1919, was promoted to assistant superintendent of the Pocahontas division. He was made superintendent of the Pocahontas division on May 1, 1931, the position he held until his recent appointment as general superintendent of the Western General division.

George D. Brooke, vice-president—operation and engineering—of the Chesapeake & Ohio and the New York, Chicago & St. Louis, and an engineer by training and experience, has been elected to the newly created position of executive vice-president of the C. & O., the N.C. & St.L. (Nickel Plate) and the Pere Marquette. Mr. Brooke was born on September 15, 1878, at Sutherlin, Va. Graduating from the Virginia Military Institute in 1900, he commenced his railway career in July, 1902, with the Baltimore & Ohio, as a rodman. From August to December, 1902, he was a levelman and from December, 1902, to May, 1904, he served as a transitman. For the following six months he had the title of field engineer, then being appointed assistant engineer, in which capacity he served successively at Baltimore and Cumberland, Md., and at Morgantown, W. Va., until July, 1908, when he was appointed assistant division engineer at Pittsburgh, Pa. From July, 1909, to March, 1911, he was division engineer at Baltimore, and at the end of this period he became an assistant engineer in the operating department. On February 1, 1912, Mr. Brooke was further advanced to assistant superintendent at Cumberland, and in September of that year he was promoted to superintendent. From May to June, 1918, he was a special representative of the transportation department at Baltimore, then entering the service of the United States Railroad Ad-

George D. Brooke

ministration as supervisor in the operating division, Allegheny region, at Philadelphia, Pa., which position he held until March, 1919, when he resumed his connection with the Baltimore & Ohio as superintendent of transportation at Cincinnati, Ohio. Mr. Brooke first entered the service of the Chesapeake & Ohio in August, 1924, as assistant to the vice-president at Richmond, Va. In October, 1926, he was advanced to general manager, and in the spring of 1930 he was appointed also vice-president. In 1933 Mr. Brooke was given the title of vice-president—operation and engineering—of the C. & O. and the Nickel Plate, with headquarters at Cleveland, Ohio. He was holding this position at the time of his recent appointment as executive vice-president of these companies and of the Pere Marquette, with the same headquarters. Mr. Brooke has been active in the affairs of the American Railway Engineering Association and served as president in 1930-31.

Howard C. Mann, chief engineer of the Union Pacific, has been promoted to vice-president in charge of operations, with headquarters as before at Omaha, Neb. Mr. Mann was born on August 30, 1885, at Missouri Valley, Iowa, and was educated in engineering at the University of Nebraska. He first entered railway service in August, 1907, as a rodman on the Canadian Pacific, remaining with that company until December, 1908. In April of the following year he entered the service of the Union Pacific as an instrumentman on double-track work, later being advanced to assistant engineer on second-track construction in Nebraska and Wyoming. In January, 1912, Mr. Mann was assigned to valuation work at Omaha, where he remained until the fall of

Howard C. Mann

that year when he became engaged on various surveys and on construction work on branch lines in Nebraska, Wyoming and Utah. In October, 1918, Mr. Mann was assigned to special work in the general office with the title of assistant engineer, being appointed engineer accountant in September, 1919. Beginning in April, 1922, he served as resident engineer and assistant engineer in charge of bridge construction on the Oregon-Washington Railroad & Navigation Co. (now the Northwestern district of the U.P.) and in June, 1923, he was placed in charge of the construction of tourist facilities for the railroad in southern Utah. In November, 1924, Mr. Mann was promoted to assistant chief engineer with jurisdiction over the Los Angeles & Salt Lake (now the Southwestern division), with headquarters at Los Angeles, Cal. Since January, 1928, he has been chief engineer of the system. His appointment as vice-president in charge of operations became effective on January 1.

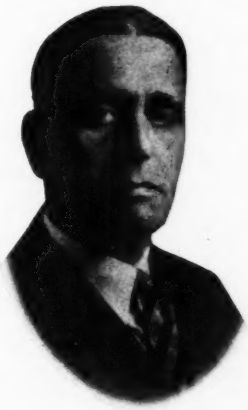
R. H. Smith, formerly a roadmaster on the Norfolk & Western, who has been appointed general manager of this road, with headquarters at Roanoke, Va., as reported in the December issue, was born in Baltimore, Md., on March 10, 1888, and was educated at Princeton University, from which he was graduated in 1911 with a degree in civil engineering. He entered the service of the Norfolk & Western on July 1, 1910, as an axeman in the engineering department at Roanoke, during a summer vacation while attending college. He re-entered the service of the N. & W. in June of the following year as a masonry inspector in the same department and on February 1, 1912, he was appointed a transitman. On June 1, 1913, he was promoted to assistant roadmaster of the Radford division at Pulaski, Va., and Roanoke. On October 15,

1914, Mr. Smith was advanced to road-master of the same division and in June, 1917, he was appointed assistant superintendent of the Pocahontas division. In October, 1919, he was transferred to the Radford division, being promoted to superintendent of that division on December 26, 1922. Mr. Smith became general superintendent of the Eastern General division in 1931, and subsequently became general superintendent of the West-

R. H. Smith

ern General division, which position he was holding at the time of his recent appointment as general manager.

F. M. Falck, general manager of the Reading and formerly a division engineer on this road, has been promoted to assistant vice-president in charge of personnel of the Reading and the Central of New Jersey, with headquarters as before at Philadelphia, Pa. Mr. Falck was born on



F. M. Falck

July 5, 1874, at Atlanta, Ga., and was graduated from Cornell University in 1896. He entered railway service in 1898, as assistant supervisor on the Philadelphia & Reading (now Reading) at Shamokin, Pa., and from May, 1899, to December, 1901, he was supervisor at Shamokin. From the latter date to May, 1902, he was supervisor on the New York division at Philadelphia, Pa., being transferred to Trenton, N. J., in May, 1902. He served as division engineer of the Shamokin division at Tamaqua, Pa., from May, 1903, to June, 1905, when he became division engineer of the Reading division at Reading. From March to October, 1910, he served as assistant superintendent of the Wilmington & Columbia division at Reading and from the latter date until January, 1913, he was superintendent of the same division, with the same headquarters. Mr. Falck served as superintendent of the Atlantic City Railroad from January, 1913, to October, 1916, and as acting superintendent of the Reading division of the Philadelphia & Reading from November, 1916, until January, 1917. During 1917 he served successively as superintendent of the Atlantic City Railroad, superintendent of the latter and also of the Delaware River Ferry Company, and as assistant general manager of the Philadelphia & Reading system at Reading. Mr. Falck was appointed general manager of the Reading in December, 1917, which position he held until his recent appointment as assistant vice-president in charge of personnel of the Reading and Central of New Jersey with headquarters at Philadelphia.

J. E. Crawford, formerly chief engineer of the Norfolk & Western, whose election as vice-president in charge of operation was reported in the December issue, was born in San Diego, Cal., on December 1,

J. E. Crawford

1876, and was educated at the University of Pennsylvania. He entered the service of the Pencoyd Iron Works in 1895 as a draftsman and was later promoted to designer in the same organization. In July, 1903, Mr. Crawford entered the service of the Norfolk & Western as acting bridge engineer and in 1904 he was appointed bridge engineer. He was appointed acting chief engineer in May, 1913, and on March 1, 1914, he became chief engineer. On February 16, 1923, he was further promoted to assistant general manager, and served in that capacity until his appointment as general manager on May 1, 1924, the position he held until his recent election as vice-president in charge of operation.

Engineering

E. G. Day, division engineer of the Peninsula division of the Chicago & North Western with headquarters at Escanaba, Mich., has been appointed chief engineer of the Lake Superior & Ishpeming, with headquarters at Marquette, Mich., to succeed **R. C. Young,** who at his own request has retired from active service with the title of consulting engineer, effective January 1. Mr. Young had been chief engineer of the Lake Superior & Ishpeming for 33 years.

W. W. Nuebling, engineer of the Alton & Southern, has been promoted to the position of chief engineer and purchasing agent, with headquarters as before at East St. Louis, Ill.

D. C. Chisholm, division engineer of the Saskatoon division of the Canadian Pacific, with headquarters at Saskatoon, Sask., who has been on a leave of absence, returned to his position on November 6.

S. S. Long, engineer and supervisor of bridges and buildings on the Chicago & North Western, with headquarters at Mason City, Iowa, has been promoted to division engineer of the Peninsula division, with headquarters at Escanaba, Mich., to succeed **E. G. Day,** whose appointment as chief engineer of the Lake Superior & Ishpeming is noted elsewhere in these columns. **A. A. Colvin,** assistant engineer at Sioux City, Iowa, has been promoted to engineer and supervisor of bridges and buildings at Mason City, to succeed Mr. Long and has been replaced as assistant engineer at Sioux City by **B. R. Meyers,** assistant general bridge inspector at Chicago. These appointments became effective on January 1.

John L. Gressitt, acting chief engineer of maintenance of way of the Western region of the Pennsylvania, with headquarters at Chicago, has been appointed chief engineer of maintenance of way of the Western region, effective January 1, to succeed **Porter Allen,** whose death is recorded elsewhere in these columns. Mr.

John L. Gressitt

Gressitt was born on April 4, 1887, at Baltimore, Md., and was educated at the Baltimore Polytechnic Institute and at Lehigh University, graduating from the latter with a degree in civil engineering. He entered railway service on August 4, 1908, on the engineering corps of the Pittsburgh division of the Pennsylvania, being advanced through the positions of chainman, rodman and transitman. On May 1, 1915, he was promoted to assistant supervisor of track on the Bellwood divi-

sion, later serving in this position at Williamsport, Pa., and at Philadelphia. From October 1, 1917, to July 10, 1919, he was in military service with the Twenty-First Engineers. After the war he returned to the service of the Pennsylvania as acting supervisor on the Monongahela division, later being promoted to supervisor, in which capacity he served during the next seven years on the Monongahela, Philadelphia Terminal and Pittsburgh Divisions. He was promoted to division engineer of the Fort Wayne division on January 16, 1927, and on December 1, 1929, he was further advanced to superintendent of the Sunbury division, with headquarters at Sunbury, Pa. In June, 1931, Mr. Gressitt was transferred to the St. Louis division at Terre Haute, and on November 1 of the same year he was further advanced to general superintendent of the Southwestern division, with headquarters at Indianapolis, Ind. Two years later he was transferred to Chicago. Since January 1, 1936, Mr. Gressitt has served as acting chief engineer of maintenance of way of the Western region.

Banus H. Prater, district engineer of the Central, Northwestern and Southwestern districts of the Union Pacific with headquarters at Salt Lake City, Utah, has been promoted to chief engineer of the system, with headquarters at Omaha, Neb., to succeed **Howard C. Mann,** who becomes vice-president in charge of operations, as reported elsewhere in these columns. **W. C. Perkins,** division engineer of the Kansas division, with headquarters at Kansas City, Mo.,

Banus H. Prater

has been advanced to district engineer at Salt Lake City, to succeed Mr. Prater. **L. I. Hammond,** general roadmaster at Cheyenne, Wyo., has been appointed division engineer with the same headquarters, to succeed **N. C. Pearson,** who has been transferred to Kansas City, to succeed Mr. Perkins.

Mr. Prater was born on November 11, 1881, at Bingham, Ill., and was educated in civil engineering at the University of Illinois, graduating in 1903. During that year and 1904 he was engaged as an instructor in the surveying and masonry laboratory and as assistant in bridge design at the University of Illinois. He first entered railway service as a track apprentice on the Illinois Central during the summer vacations while attending the university, during which periods he also served as a shop apprentice with the Illinois Steel Company and as a clerk with the American Bridge Company. Mr. Prater was employed as a transitman on the construction of the Panama canal in 1904 and 1906. He entered the service of the Oregon Short Line (now part of the Union Pacific) in the latter year as a draftsman and was subsequently promoted to chief draftsman, office engineer and engineer of buildings. In 1918 he left railway service to become manager of the supply division of the Chester Shipbuilding Company, Chester, Pa., but on May 12, 1919, he returned to the Oregon Short Line as engineer of maintenance of way, with headquarters at Pocatello, Idaho, being advanced to assistant chief engineer with headquarters at Salt Lake City, in 1925. Early in 1929 Mr. Prater's title was changed to chief engineer and early in 1936, when the various units of the Union Pacific System were consolidated under the name of the Union Pacific Railroad, Mr. Prater's title was changed to district engineer, his jurisdiction extending over the Central, Northwestern and Southwestern districts.

W. C. Perkins

Mr. Perkins was born on December 20, 1888, at Soldier, Idaho, and was educated in civil engineering at the University of Idaho. He entered railway service on September 21, 1916, in the engineering department of the Oregon Short Line, with headquarters at Pocatello, Idaho. In the following year he enlisted with the Twenty-third Engineers and served overseas. Following the war he returned to railroad service with the Union Pacific as assistant roadmaster on the Montana division, where he was later promoted to roadmaster. Subsequently he was advanced to division engineer of the same division, then being transferred to the Utah division. On August 18, 1931, Mr. Perkins was appointed roadmaster of the Utah division, and on May 25, 1932, he was advanced to division engineer of the Kansas division. From January 1, 1933, to August 10, 1934, he served as roadmaster and general roadmaster on the Oregon Short Line. Late in 1934 he was reappointed division engineer of the Kansas division, which position he was holding at the time of his recent appointment.

Track

C. H. Schutt, supervisor of bridges and buildings on the Northern Pacific at Fargo, N. D., has been appointed trainmaster-roadmaster with headquarters at East Grand Forks, Minn.

K. S. Sale, a track foreman on the Illinois Central, has been promoted to supervisor with headquarters at Vicksburg, Miss., to succeed **Warren W. East,** whose death is reported elsewhere in these columns.

H. E. Preece has been appointed roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Gallup, N.M., to succeed **R. E. Patton,** who has been transferred to San Bernardino, Cal., to replace **A. Ray,** who has retired.

S. Payson, roadmaster on the St. Louis-San Francisco at Enid, Okla., effective December 16, was transferred, with the same headquarters, to the Sixty-Second Track division to succeed **E. M. Cheatham,** assigned to other duties.

J. F. Nellis, engineer-inspector on the Wabash, has been promoted to supervisor on the St. Louis Terminal division, St. Louis, Mo., to succeed **F. C. Flynn,** whose appointment as assistant trainmaster is noted elsewhere in these columns.

E. G. Brisben, assistant engineer on the Michigan Central at Jackson, Mich., has been appointed acting roadmaster, with the same headquarters to succeed **L. E. Keeler,** who has been granted a leave of absence because of ill health.

Owen H. Carpenter, roadmaster on the Nebraska division of the Union Pacific, at Cheyenne, Wyo., has been promoted to general roadmaster of the Wyoming division, with the same headquarters, to succeed **L. I. Hammond,** whose promotion to division engineer is noted elsewhere in these columns. **E. Crawford,** a gang foreman, has been promoted to roadmaster at Cheyenne to succeed Mr. Carpenter.

L. R. Bailey, assistant supervisor on the Baltimore division of the Pennsylvania, has been promoted to supervisor on the Philadelphia division, with headquarters at Columbia, Pa. **G. C. Vaughan,** assistant supervisor on the Middle division, has been appointed acting supervisor in the office of the engineer maintenance of way of the Eastern Pennsylvania division.

J. W. Neikirk, extra gang foreman on the Norfolk & Western, has been promoted to assistant roadmaster on the Radford division, succeeding **J. R. Altizer,** who has been transferred to Portsmouth yard on the Scioto division. **H. B. McColgan,** chainman in the engineering department, has been appointed assistant roadmaster on the Norfolk division, and **R. W. Clifton, Jr.,** also from the engineering corps, has been appointed assistant roadmaster on the Pocahontas division, with headquarters at Grundy, Va.

J. W. Zettelmier, supervisor on the Minneapolis & St. Louis at Oskaloosa, Iowa, in charge of the First district of the Eastern division, has been transferred to Fort Dodge, Iowa, where he will have supervision over the First district of the

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WOODINGS-VERONA TOOL WORKS
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Central division and over that part of the Second district between Tara, Iowa, and Valley Junction. **F. B. Clark,** supervisor of track at Fort Dodge, has been transferred to Oskaloosa, where he will have supervision over that portion of the Eastern division extending from Oskaloosa to Bartlett, Ill., and from Oskaloosa to Albia, Iowa, and to Tracy. These changes became effective on December 15.

O. Otherson, a section foreman on the Kootenay division of the Canadian Pacific, has been promoted to roadmaster with headquarters at Lake Windermere, B. C., to succeed **W. H. Kirkpatrick,** who has been transferred to the E. & N. division on Vancouver Island, where he replaces **J. Anderson,** who retired on December 31. On November 6, **V. H. Carruthers,** who had been temporarily assigned to the position of division engineer of the Saskatoon division at Saskatoon, Sask., resumed his position as roadmaster at Lanigan, Sask., replacing **F. W. Hooper,** who was appointed roadmaster at Wadena, Sask. **A. Eremko,** who had been relieving Mr. Hooper at Wadena, returned to the position of section foreman at Yorkton, Sask.

J. E. Yewell, chief draftsman on the Bessemer & Lake Erie, has been promoted to supervisor of track, with headquarters at Greenville, Pa., to succeed **W. E. Carter,** who has retired. Mr. Yewell obtained his education in civil engineering at Cornell university, graduating in 1912. On January 13, 1913, he entered the service of the B. & L.E. as a draftsman, being advanced to chief draftsman on April 1, 1917. He held this position continuously until his recent appointment as supervisor of track, effective December 1.

Mr. Carter retires with a record of 39 years of continuous service with the B. & L.E. He entered railroad service at the age of 14 as a water boy on the Toledo, St. Louis & Western (now part of the New York, Chicago & St. Louis) serving with this company for 15 years and advancing to the position of supervisor. In 1897 he accepted a position as supervisor of track with the Bessemer & Lake Erie, holding this position until his retirement.

Darel DeVore, acting track supervisor on the Toledo division of the Pennsylvania, with headquarters at Toledo, Ohio, has been appointed track supervisor on the same division with headquarters at Marion, Ohio, to succeed **C. B. Brown,** who has been transferred to Toledo, Ohio, where he replaces **H. D. Van Vranken,** transferred.

Mr. DeVore was born on July 23, 1889, at Forest, Ohio, and first entered railway service in 1901 as a water boy for an extra gang on the Fort Wayne division of the Pennsylvania. In 1906 he was appointed assistant foreman of an extra gang on the same division, his service during this period being confined to the summer months. On April 17, 1917, Mr. DeVore was appointed a clerk in the transportation department on the Fort Wayne division and on December 1 of the same year he became a trackman on that division, being advanced to track foreman on December 4, 1918. On May 16, 1927, he was appointed an extra gang foreman on the Fort Wayne division, returning to the position of track foreman on October 31, 1929. In the following year he was advanced to assistant supervisor of subdivision No. 3 of the Fort Wayne division, again being returned to track foreman on October 1, 1931. On January 24, 1934, he was appointed acting supervisor of subdivision No. 2 of the Fort Wayne division, again assuming the position of track foreman on December 17 of the same year. On January 6, 1936, he was reappointed to the position of acting supervisor on the Fort Wayne division, being transferred to the Toledo division on October 1. His promotion to supervisor became effective on December 1.

Mathias E. Noel, general extra gang foreman on the Chicago, Milwaukee, St. Paul & Pacific, whose promotion to roadmaster with headquarters at Janesville, Wis., was reported in the December issue, has been identified with the Milwaukee for 22 years. He was born on November 11, 1900, at Reno, Minn., and entered the service of the Milwaukee on August 1, 1914, as a section laborer. Five years later he was advanced to section foreman, holding this position until April 1, 1922, when he was further promoted to assistant extra gang foreman on the Dubuque division. On September 1 of the same year Mr. Noel returned to the position of section foreman, which he held until April 16, 1932, when he was advanced to extra gang foreman, holding this position during the three subsequent working seasons and the position of section foreman during the winter months. During the working seasons of 1935 and 1936, Mr. Noel served as general extra gang foreman.

A. W. Miller, assistant supervisor of track on the Baltimore division of the Pennsylvania, whose appointment as supervisor of track on the Grand Rapids division, with headquarters at Petoskey, Mich., was reported in the November issue of *Railway Engineering and Maintenance,* was born on July 4, 1907, at Sharon, Pa. Mr. Miller attended Carnegie Institute of Technology, graduating in 1929, and entered the service of the Pennsylvania on July 22 of the same year, as an assistant on the engineering corps of the Philadelphia division at Lemoyne, Pa. On January 1, 1930, he was advanced to assistant supervisor of track on the Williamsport division, with headquarters at Millersburg, Pa., being transferred to Lock Haven, Pa., on October 22, 1931. On May 5, 1932, Mr. Miller returned to the Philadelphia division as an assistant on the engineering corps, with headquarters at Enola, Pa., and on October 1, 1933, he was again promoted to assistant supervisor on the Delmarva division, with headquarters at Clayton, Del. On February 1, 1934, he was transferred to the Middle division, with headquarters at Newport, Pa., and on October 23, 1934, he was further transferred to the Maryland division at Perryville, Md. He was located at the latter point at the time of his promotion to supervisor of track, with headquarters at Petoskey, which was effective on October 1.

Bridge and Building

L. L. Harding, acting assistant supervisor of bridges and buildings on the Baltimore and Maryland divisions of the Pennsylvania, has been appointed assistant supervisor of bridges and buildings on the Middle division, with headquarters at Newport, Pa.

Angel Monson has been appointed supervisor of bridges and buildings on the Northern Pacific, with headquarters at Glendive, Mont., to succeed **Andrew Hanson,** who has been granted a leave of absence. **Seymour H. Knight** has been appointed supervisor of bridges and buildings at Fargo, N.D., to succeed **C. H. Schutt,** whose appointment as trainmaster-roadmaster is noted elsewhere in these columns.

Ashby A. Riley, assistant supervisor of structures of the Southern Pacific Lines in Texas and Louisiana, whose promotion to supervisor of structures with headquarters at Houston, Tex., was reported in the December issue, was born on July 5, 1884, at Belleville, Ala. Mr. Riley received his higher education at Texas Agricultural & Mechanical College, graduating with bachelor of science degree in civil engineering in 1909. In June of the same year he entered the service of the Texas & New Orleans (now part of the Southern Pacific Lines in Texas and Louisiana) as a rodman, later serving as a draftsman and assistant engineer. In May, 1917, Mr. Riley entered an officer's training camp and later served as a first lieutenant of engineers with the 40th Division of the A.E.F. Returning from military service in July, 1919, he resumed his connection with the Texas & New Orleans as assistant engineer in the superintendent's office. In 1920 he was appointed chief draftsman in the chief engineer's office, holding this position until October, 1936, when he was appointed assistant supervisor of structures.

Obituary

Leonard L. Sparrow, engineer of statistics of the Atlantic Coast Line, with headquarters at Wilmington, N. C., died on November 25 in that city, at the age of 64 years.

M. B. Morgan, district engineer of the Southern lines of the Illinois Central with headquarters at New Orleans, La., died at the Illinois Central hospital in Chicago on December 26.

Warren W. East, supervisor of track on the Illinois Central with headquarters at Vicksburg, Miss., was killed in an accident on November 29. Mr. East was born on March 24, 1880, at Lorman, Miss., and entered the service of the Illinois Central on September 16, 1898, as a section laborer at Natchez, Miss. Three years later he was advanced to section foreman at Patterson, Miss., and on March 7, 1908, he was further promoted to supervisor on the Meridian district, which position he held until his death.

Burton W. Farnham, resident engineer in the department of the engineer of

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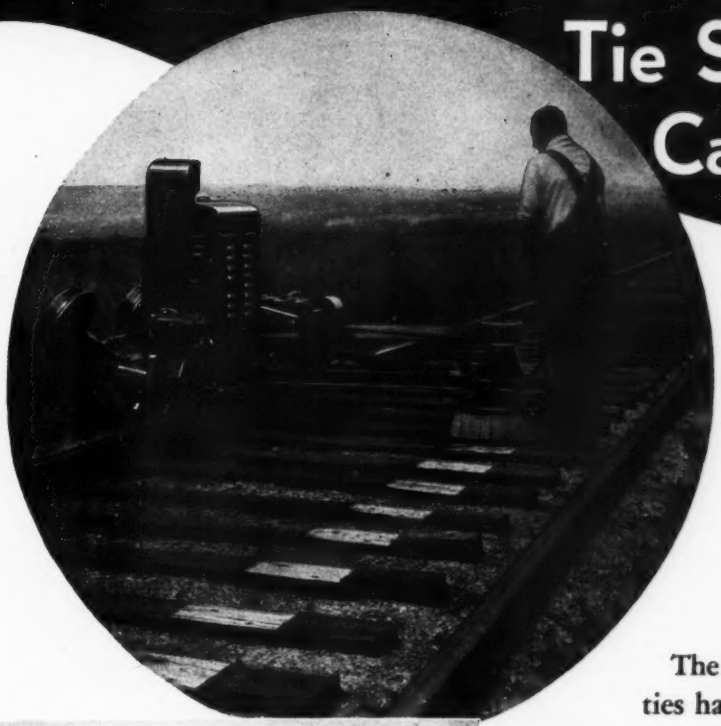

Three Nordberg Adzing Machines serving a rail-laying gang of about 160 men.

The old method of hand adzing ties has been outlawed on many of the major roads. Past experience has shown the error of laying new rail on uneven ties. Permanent damage to rail and tie plates is traceable to improperly prepared tie seats. Uneven bearing on ties further has the tendency of throwing the newly laid rail out of line and gauge. The investment involved in rail and fastenings demands that tie seats be as near perfect as can possibly be obtained.

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Rail Grinders
Rail Drill
Track Wrench
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grade crossings of the New York Central, with headquarters at New York, died in that city on December 18, following approximately 35 years service in the engineering department of the road. Mr. Farnham was born at Williamstown, Vt., in 1868, and was graduated from Norwich university in 1891. Following approximately 10 years service in the office of the city engineer of Lowell, Mass., Mr. Farnham entered the employ of the New York Central on February 11, 1902, as a rodman. Later he was appointed levelman and then transitman, and in 1905 he became general inspector in the construction department, with headquarters at Schenectady, N. Y. In 1910, he was promoted to resident engineer at Rochester, N. Y., and in 1917, he was again promoted to assistant district engineer, with headquarters at Albany, N. Y. In 1918, Mr. Farnham was appointed assistant engineer at Buffalo, N. Y., and in 1922, he became resident engineer on the Hudson River Connecting Railroad, with headquarters at Selkirk, N. Y. In 1926, he was appointed district engineer on the Middle division of the Lines Buffalo and East, with headquarters at Albany, and in 1929, he became resident engineer in the office of the engineer of grade crossings, which position he held at the time of his death.

J. J. Vail, special engineer in the construction department of the New York zone of the Pennsylvania, with headquarters at Newark, N. J., died on December 2, 1936, following approximately 38 years of service in the construction department of that road. Mr. Vail was born at Rahway, N. J., on September 14, 1877, and was graduated from Rutgers university in 1902, with the degree of B.S. in C.E. He began his railway career on December 7, 1898, as a levelman on the Pennsylvania, and on May 1, 1901, he was promoted to transitman. On July 1, 1918, he was promoted to assistant engineer, and on August 1, 1928, he was promoted to engineer of construction, New York zone. On October 1, 1931, Mr. Vail was appointed assistant engineer, and on September 1, 1933, he was made special engineer, New York zone, which position he held at the time of his death. During the last 10 years or more, Mr. Vail had been connected with some of the more important construction projects carried out on the New York zone of the road, including the road's large lift-span bridge over the Hackensack river in New Jersey, and its extensive passenger station improvements at Newark, N. J.

George C. Cleveland, who retired in 1924 as chief engineer of the New York Central, West of Buffalo, with headquarters at Cleveland, Ohio, died on December 15. Mr. Cleveland was born on March 8, 1854, at Dover, Mass., and first entered railway service in 1873 with the Providence & Springfield (now part of the New York, New Haven & Hartford), serving as a rodman and instrumentman. From 1874 to 1879 he was in the service of the city of Boston, Mass., in an engineering capacity. At the end of this period, Mr. Cleveland entered private engineering practice at Newton, Mass., and in 1880 he entered the service of the Mexican Central, where subsequently he became principal assistant to the chief engineer. In 1891, after spending six years in private practice in Los Angeles, Cal., Mr. Cleveland entered the service of the Lake Shore & Michigan Southern (now New York Central) as principal assistant engineer, serving in this capacity until 1901, when he was made assistant chief engineer of the Lake Erie & Western (now part of the New York, Chicago & St. Louis). In 1905 he returned to the L. S. & M. S. as assistant chief engineer, being promoted to chief engineer at Cleveland, Ohio, in 1912. When the L. S. & M. S. was absorbed by the New York Central in 1915, Mr. Cleveland continued as chief engineer at Cleveland, retiring in 1924.

Porter Allen, chief engineer maintenance of way of the Western region of the Pennsylvania, with headquarters at Chicago, died at his home in Winnetka, a suburb of Chicago, on December 12, following an illness of several months. He was born at Williamsport, Pa., on August 15, 1880, and graduated from La-

Porter Allen

fayette College in 1902. He entered the service of the Pennsylvania on June 21, 1902, as a rodman in the office of the principal assistant engineer at Williamsport, Pa. In August of the same year Mr. Allen was transferred to Elmira, N.Y., being advanced to transitman at Altoona, Pa., in 1905. On March 10, 1906, he was promoted to assistant supervisor and on August 1, 1911, he was appointed supervisor at Uniontown, Pa. From May 1, 1915, to September 16, 1918, Mr. Allen served in this capacity on the Buffalo division at Olean, N.Y., and on the Middle division, then being promoted to division engineer of the Cleveland and Pittsburgh division of the Central region, with headquarters at Cleveland, Ohio. In 1923 he was appointed superintendent of the South Bend division, with headquarters at Logansport, Ind., being transferred to the Norfolk division, with headquarters at Cape Charles, Va., in the following year and thence to the Eastern division of the Central region, with headquarters at Pittsburgh, Pa., in September, 1926. On June 1, 1927, he was promoted to chief engineer maintenance of way of the Western region, with headquarters at Chicago, which position he held until his death.

Supply Trade News

General

The Wood Preserving Corporation has moved its Boston, Mass., sales office to its plant at Nashua, N. H.

Sika, Inc., has moved its office from the Grand Central Terminal building to 330 W. 42nd street, New York City.

Upon the affirmative approval of approximately 95 per cent of all the creditors of the **Roberts & Schaefer Company,** Chicago, the U.S. District Court in that city approved the plan of reorganization of this company on December 22.

Personal

J. E. Mahoney, representative of the **P. & M. Company,** Chicago, has been promoted to Chicago district sales agent.

James A. Drain, Jr., eastern representative of **Sperry Products, Inc.,** Brooklyn, N. Y., who has been associated with the development and operation of the transverse fissure detector equipment of that company since its inception in 1927, resigned, effective December 12, to become president of the **Stefco Steel Company,** Michigan City, Ind., manufacturers of pre-fabricated standard steel buildings.

Charles A. Alden, chief engineer, frog and switch division, **Bethlehem Steel Company,** retired at his own request on November 30. In addition to his work with the steel company, Mr. Alden has long been active in the work of the Manganese Track Society and the Track Committee of the American Railway Engineering Association in developing standards for open-hearth and manganese track work.

J. A. Krugler has been appointed general sales manager of the **Taylor-Wharton Iron & Steel Company,** High Bridge, N. J., effective December 1, to succeed **J. C. Taylor, Jr.,** resigned. Mr. Krugler was born in Pottstown, Pa., and attended Rensselaer Polytechnic Institute. For the last 12 years he has served the Taylor-Wharton Iron & Steel Company as sales engineer. Previous to his connection with this company his experience was in railroad and mining engineering.

At a meeting of the board of directors of the **Timken Roller Bearing Company,** Canton, Ohio, on December 5, **Frederick J. Griffiths** resigned as a director and as president and director of its wholly-owned subsidiary, the **Timken Steel & Tube Company. William E. Umstattd,** president of the parent company, was elected also president of the subsidiary and **H. H. Timken, Jr.,** previously a vice-president of the Timken Steel & Tube Company, was made its executive vice-president, in addition to his present duties as vice-president and director of the Timken Roller Bearing Company. **W. Robert Timken** was elected a director of both companies.

The Dawn of a Brighter Day

The railways are coming back. 1936 was their best year since 1931.

Operating revenues increased 16%—net railway operating income rose $145,000,000 or 29%.

Expenditures for roadway maintenance and improvement increased $62,000,000 or 16% last year.

And purchases from manufacturers increased 80% or from $402,000,000 in 1935 to $712,000,000 in 1936.

Equally important, both earnings and expenditures increased progressively during the year.

Still greater increases are in prospect for 1937.

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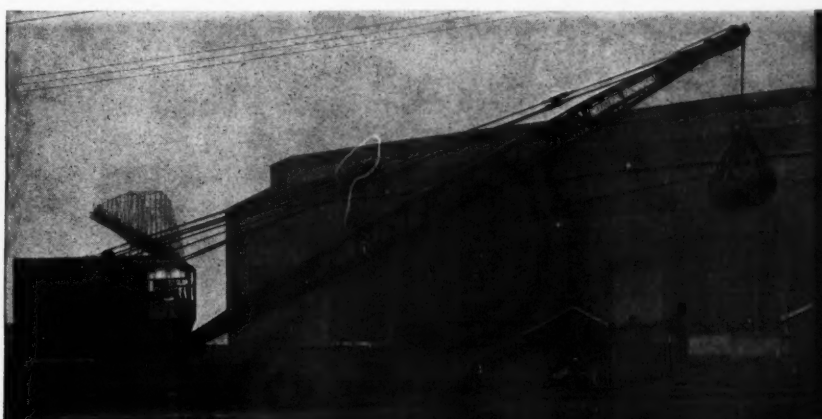

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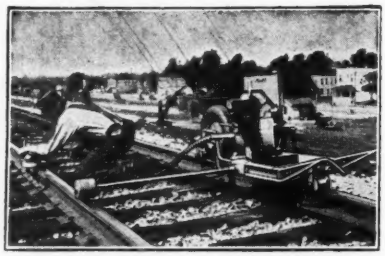

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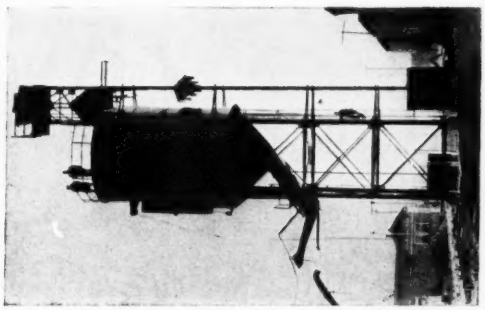

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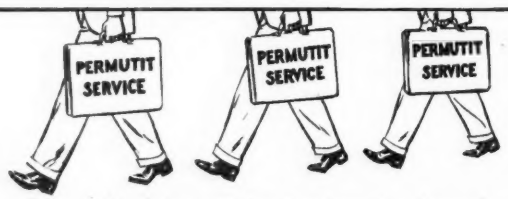

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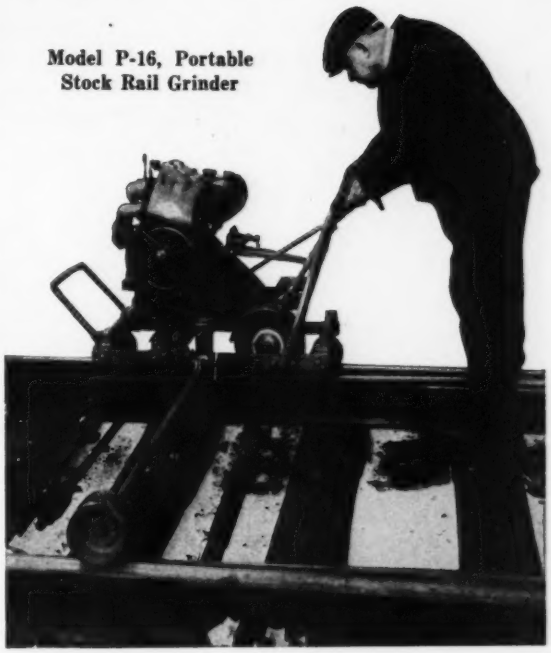

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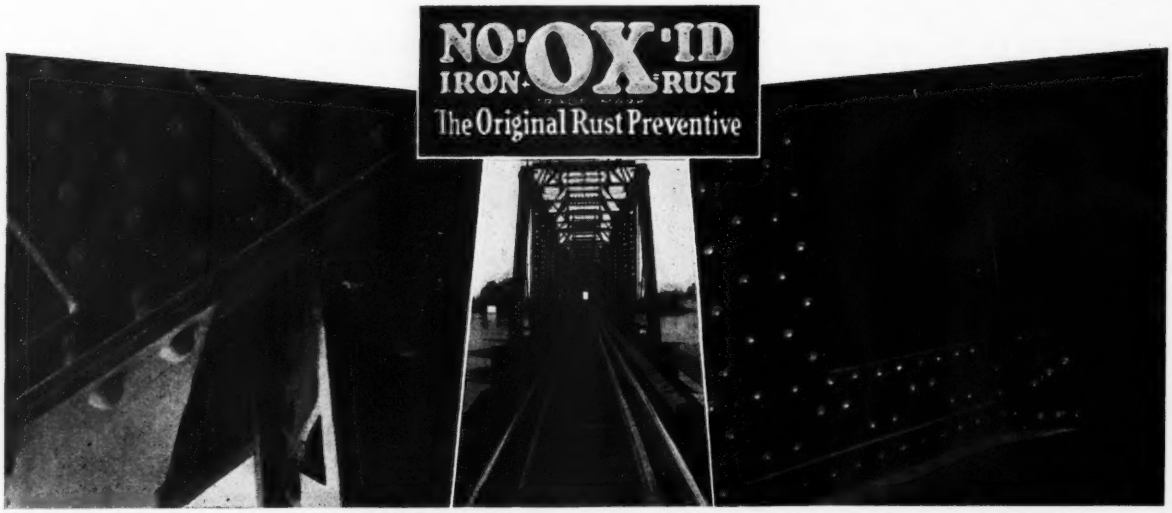

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A

Air Reduction Sales Company....18
Armco Culvert Mfrs. Assn....11

B

Barco Manufacturing Company....63

C

Carnegie-Illinois Steel Corporation....8-15
Columbia Steel Company....8-15

D

Dearborn Chemical Company....62

E

Eaton Manufacturing Co.... 2

F

Fairbanks-Morse & Co....10
Fairmont Railway Motors, Inc.... 7
Fleming Co., The.... 1

I

Industrial Brownhoist Corp....59
Ingersoll-Rand 13
Ingot Iron Railway Products Co....11

L

Lehon Company, The....59
Lufkin Rule Co., The....58

M

Maintenance Equipment Co.... 1
Mall Tool Company....60
Metal & Thermit Corporation....64

N

Nordberg Mfg. Co....55

O

Oxweld Railroad Service Company, The.... 6

P

Permutit Co., The....60

R

Railroad Accessories Corporation.... 3
Railway Maintenance Corporation.... 9
Railway Track-work Co....61
Ramapo Ajax Corporation.... 4- 5
Ross and White Company....60

S

Simmons-Boardman Pub. Co....57-58-60-61

T

Taylor-Wharton Iron & Steel Co....58
Timken Roller Bearing Company, The....12
Truscon Steel Company....16

U

Union Carbide and Carbon Corp.... 6
United States Steel Corporation Subsidiaries 8-15
United States Steel Products Company.. 8-15

W

Woodings Forge and Tool Co....53
Woodings-Verona Tool Works....53

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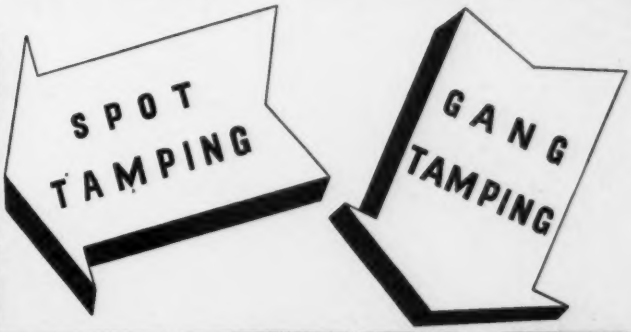

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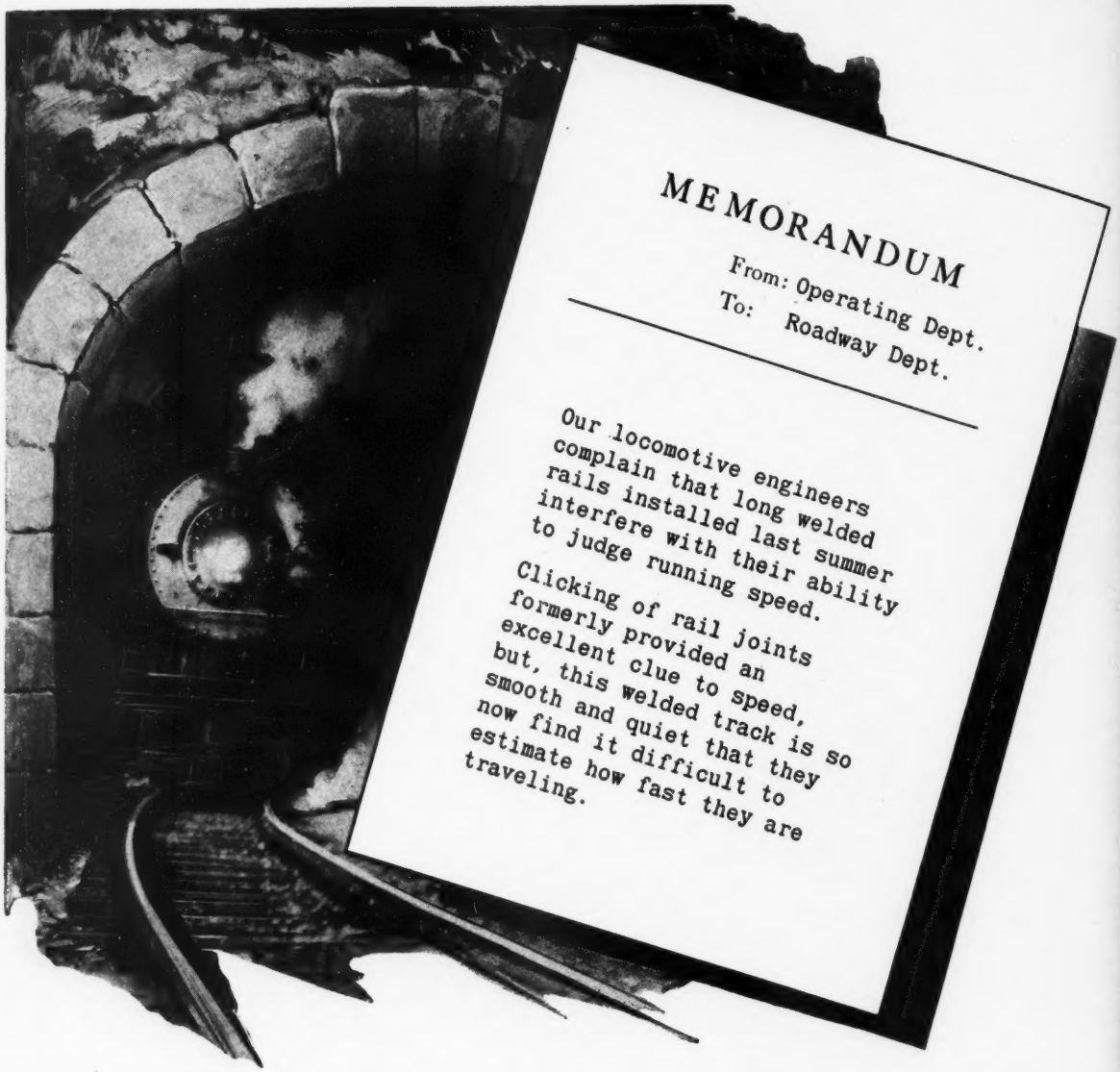
MEMORANDUM
From: Operating Dept.
To: Roadway Dept.
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